ARCHITECTURE

VENTILATION

AND

FURNISHING

OF

School Houses

BY

OLIVER E. WELLS

STATE SUPERINTENDENT

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General Suggestions.

The recommendations and suggestions contained in this circular embody the results of long experience in the school room. They are sanctioned by those whose opinions are entitled to weight in such matters. The writer is indebted for valuable hints in various ways to an able circular issued in 1886 by Dr. Hodgkins, of Ontario.

The purpose of this circular is to offer suggestions in regard to the selection of suitable schoolhouse sites, and the erection of commodious school buildings. It seeks to guide and, so far as it may, to stimulate district boards to greater care and diligence in the conduct of this important factor of school interests.

In 1881 Superintendent Whitford sent from this office an able circular embodying his own views and suggestions, and embracing carefully prepared plans of schoolhouses and sites.

There is abundant evidence that this paper was fruitful in many ways. Unfortunately, the evidence is equally abundant that it is still needful to direct attention to the inadequate houses and untidy surroundings in which so many of the pupils of the public schools spend the years that are most potent in determining the character and conduct of their after lives. In the cities and larger villages of the state, school buildings and grounds are often, perhaps generally, a credit to the good taste and public spirit of the communities in which they are situated.

But away from these centers of population many of the school buildings are blots on the landscape. Built without reference to architectural effect, or to the health, comfort and convenience of teacher and pupils, they bar progress in school work.

Many of these buildings are in a shameful state of dilapidation, and when new ones are built it is thought unnecessary, or too expensive, to employ professional help, and so the defects of the old school buildings are perpetuated in the new ones.

All this is evidence that it is still needful to arouse and educate public sentiment upon this subject; to tell the people that the comfort and health and eye-sight of teachers and pupils are worth caring for; to insist again that neat and attractive buildings and grounds are important contributions to the mental and moral well-being of the children.

It is believed that effective help may be afforded to school boards by suggestions as to the best methods of choosing, laying out and adorning sites, and by furnishing them the latest information and the most meritorious designs in school architecture.

Selection of the School Site.

It is, of course, desirable that the schoolhouse should be placed near the geographical center of the district; but neither the health of pupils, nor the beauty and wholesomeness of surroundings should be sacrificed to this purpose. An additional half mile's travel will be labor well expended, if it place pupils amid wholesome and attractive scenes.

An elevated piece of ground, a knoll, or a gentle slope should be chosen, for the obvious reason that the drainage should be from, and not toward the site. Sand or gravel sub-soil affords natural drainage, and a southern or eastern slope secures the rapid evaporation of surface water, and is most favorable to the admission of health-giving sunlight. A schoolhouse ought never to be built on low or marshy ground, near stagnant pools, or in the neighborhood of offensive odors.

Persons engaged in physical toil may escape unharmed in the midst of effluvia which would seriously endanger those of less active employment. Children at school are especially subject to the deleterious effects of noxious gases and impure air, both on account of their long continued physical inactivity, and their concentration of thought upon their lessons, to the neglect of bodily sensations.

These depleting influences exhaust vital force, and, as a consequence, the power of resisting disease, leaving the system exposed to the whole brood of difficulties whose source is blood-poisoning. Where a site with natural drainage cannot be secured, artificial drains are indispensable. Underdraining is preferable, but open drains are better than pools of water on or near the premises. Decaying vegetation and stagnant water are fruitful sources of disease and death.

Natural groves of timber lying at the north and west of school buildings conduce to the comfort and beauty of the place; but trees should never be permitted to interfere with the free circulation of air, or to obstruct the sunlight from house or grounds.

Area of the Site.

This department has uniformly advised boards to secure sites containing at least one acre. Under the provisions of law this amount may be taken without the consent of the owner, but with his consent any amount may be obtained. Enough should be secured so that the schoolhouse may be placed well back from the road, away from its dust and noise, leaving room in front for a smooth plat of turf, and, in the rear, for outbuildings and play grounds.

When an acre of ground is obtained, the following plan is recommended. Let the site be ten rods on the road and sixteen rods deep. Leave at least fifty feet in front for grass and flowers. A woodhouse should be built in the rear or attached to the schoolhouse, and separate privies should be built so far apart that conversation in one cannot be heard in the other. A screen of boards or of trees should hide them from the road, and a tight board fence running from the woodshed or rear of the schoolhouse to the rear of the lot, should separate the playgrounds from each other.

The Well or Water Supply.

On every schoolhouse site there should be a well, or some other means of procuring water, so placed and guarded as to be perfectly secure against pollution from surface drainage, or filth of any kind.

No subject, except that of ventilation, is more closely related to the health of pupils than an abundant supply of pure drinking water. Disease germs

often lurk in water that is sweet to the taste, and perfectly transparent to the sight. Impurities in clear water can only be detected by chemical tests or analyses. Surface water is usually laden with organic matter, which in its decomposition sets free hurtful gases that are readily absorbed by cold water. To exclude such water the well should be sunk on high ground, and, if it be stoned or bricked, the upper two or three feet should be built with hard brick, laid in water-lime; and a brick dome should be built over the top, leaving a man-hole, which may be closed by a flat stone set in cement.

In porous soils — loose sand or coarse gravel — animal and vegetable matter are carried long distances under-ground by soaking rains and melting snows. This tainted water, soaking through loose soils, or trickling along fissures in the rock, intercepts and poisons the hidden currents that are the sources of supply for wells. To avoid this dangerous contamination, school house sites ought to be removed as far as possible from privy vaults, pig pens, stables, and other places where animal and vegetable matter are left to decay on the surface. In loose soils, tube or driven wells are safer than others. These are effective in keeping out worms, toads and other animals; and where the water supply is far below the surface, are much less likely to be infected by leachings from privy vaults.

Privies.

The construction and care of privies is a difficult part of school management. Much has been written and said about it, but the utterly repulsive condition of most of these necessary conveniences shows that progress in this matter has been very slow. Nevertheless, the interests of life, health and decency demand that the struggle should be continued. The following rules ought to be rigidly observed in their construction.

1. They should be private, that is, masked or screened from observation. A row of Balsam fir or Norway spruce planted between the privies and the road will make an effective screen in a few years, and will add greatly to the beauty of the place.

2. They should be separate, out of sight and out of mind, each from the other.

3. They should be well lighted and well ventilated.

4. They should be constantly supervised, — kept clean.

The last rule can be obeyed only by constant and discreet vigilance. It will impose on teacher or janitor duties that are always unpleasant and may sometimes seem to be indelicate, but the abhorrent condition of school privies demands that almost any sacrifice be made to save children from the mental and moral degradation incident to daily contact with indecency.

Generally a little plain talk to the boys will secure the co-operation of the well disposed. With their aid, vigilant care on the teacher's part will beget a sentiment that will restrain the thoughtless.

These outbuildings should be plainly, but substantially built; they should be raised at least one foot above the ground, and placed on substantial foundations. Inside walls and ceilings should be covered with matched boards, and on the last coat of paint sand should be sifted to prevent marking. These buildings should be separated into compartments by board partitions six feet in height. In the boys' privies urinals should be provided discharging into the vaults, and in each one seat should be provided so low that young children may occupy it and still rest the feet on the floor. The receptacle for excrements should be made water-tight, so that no portion of them can be filtered into the ground. Vaults may be of brick with brick floors, extending one foot beyond and in the rear of the building. The vault floor should slope toward the rear to facilitate cleaning, and the projection of the vault should be closed by a tightly fitting door, hinged to the house and secured by a lock. From the vault a tight wooden flue, six inches square, should extend above the roof and in the rear of the building for ventilation. The contents of the vaults should be frequently covered with dry earth or dry wood ashes, and the vault should be cleaned in vacation and thoroughly disinfected. A cheap and effective disinfectant may be had by dissolving chloride of lime in water, using one pound to a gallon of water. This may be used to disinfect urinals, and, if sprinkled occasionally over the floors of outbuildings and then washed off, will help to render their condition tolerable.

General Recommendations.

The plans herewith submitted are designed to meet the wants of country districts and of villages that may need houses of but one to four rooms.

Other plans are given for city schoolhouses, as possible aids to boards, but it is understood that in the main cities will build according to the plans and specifications of architects. The fundamental considerations in the construction and arrangement of schoolhouses are health, comfort, convenience and cost. Of these health is of first importance. Education that costs the impairment of health, or of constitutional vigor, is purchased too dearly.

Neat and tasteful schoolhouses and grounds have an educational value that is beyond price. With proper care and forethought these may add a beauty to the landscape that in reflex influence is inestimable; but neither health, nor comfort, nor convenience should be sacrificed to architectural conceits. Stone and brick are more durable than wood, and they give an air of strength and solidity that adds greatly to the beauty of public buildings. When used for school buildings, air spaces should be provided between walls and plastering by furring. When wood is used, the exterior of the building should be painted in sober colors, — drab, gray or brown.

The ground under school buildings should be cleared of all rubbish; nothing should be left to taint the air by its decomposition. Schoolhouses should always be placed on substantial stone foundations at least two feet above the ground, and free circulation of air under the floor should be provided by openings in the wall, protected by screens or iron rods.

School rooms ought to be at least twelve feet between floor and ceiling, and large enough to afford wide spaces about the stove, for aisles, and for the convenience of recitation classes.

Floors of smooth, narrow, hardwood boards, well oiled or painted and well matched, conduce to health and cleanliness. An excellent finish may be obtained by oiling two or three times before using, and, during the first year, when the floor is cleaned, and while it is moist, laying a fold of cloth saturated with raw linseed oil in the mop and passing it again over the entire floor. Softwood floors are very soon worn into hollows and are splintered in such a way as to hold accumulations of dirt, which, when dried and trodden into impalpable dust, load the air with the seeds of sickness that enter the system by respiration. All school room floors should be doubled, and a lining of doubled sheets of felt paper should be laid between the floors, in the interest both of economy and comfort.

In country schoolhouses and in primary rooms the base of blackboards should be about two and one-half feet from the floor. Wainscoting under blackboards should be crowned with a trough to receive crayons and chalk dust. Windows should be neatly cased and capped and should extend upward as near to the ceiling as the proportions of the building will allow. They should be grouped in twos, threes, etc , and be large enough to afford sufficient light in cloudy weather, and should be furnished with shades or inside blinds. The latter are much to be preferred and, in the end, will be found quite as economical. Moreover, inside blinds are the only means known by which the quantity of light and the mode of its admission can be regulated. These blinds should be made in four leaves, all having rolling slats, but no panels. The quantity of light should be sufficient to stimulate fully, but not to dazzle the faculty of vision. It should come from above the level of the pupil's eye and in a manner that will not interfere with its free transmission by the reflection of shadows. Large panes of plate glass, of uniform density, free from flaws and irregularities, are best for this purpose. Unimpaired vision will compensate parents for added cost.

It will add much to the appearance of the room if the inside finish be of

hardwood, oiled or varnished. It costs little more to make the room large enough to furnish wide, open spaces for aisles, stove and recitation seats. These spaces add to the convenience and comfort of pupils and teacher, and lessen the danger from vitiated air.

Dark corners ought to be avoided. Wardrobes should open into the room so as to be in sight of persons in the main room. They should be furnished with heavy iron hooks, one row of which should be placed within the reach of small pupils. Pigeon holes for overshoes and cupboards for dinner pails ought also to be furnished. More than one entrance to schoolhouse and grounds is desirable.

The walls should be plastered with three-coat work, and, where blackboards are to be made, plaster-of-paris should be used with each coat, and the lath should be stayed by doubling the studding. These walls should be colored gray, or reddish brown. If the ceiling is to be plastered, the joists should be well bridged to prevent sagging. It is desirable that the ceilings should be made of narrow strips of matched boards, and painted some light neutral tint. Where the foundation is good, so that the building does not settle or the walls crack, a fairly good blackboard may be made by laying three or four coats of liquid slating on the ordinary plaster. A better board may be made by putting sharp sand in the last coat of plaster that covers the spaces designated for this purpose. After this is dry, well calendared manila paper of medium thickness may be pasted and dried smooth, which will receive liquid slating as a wall does, and should be rubbed down with fine sand paper. Where walls are badly cracked the manila paper may be used as above. The top of the board should be six and one-half feet from the floor, to enable teachers to put work on the board to remain from day to day. For the convenience of young children, the board should reach to within two and one-half feet of the floor.

Heating and Ventilation.

These topics are treated together because ventilation in school hours can be effected only by means of heating apparatus. It ought to be too late to recall the well worn proofs that air loaded with organic matter, "school room air" as it is called, is the great source of nervous disorders, of physical depres-

sion, of tubercular diseases and consumption. That school children are peculiarly subject to the baneful influence of impure air has been already pointed out. It may be added here that their vivacity and sprightliness, so far from enabling them to endure these noxious influences with impunity, only serve to conceal the disorganization of lungs and nervous system until it is too late to apply the remedy.

The air of a closed and crowded school room is tainted in various ways. It is devitalized by passing over super-heated surfaces of iron; the lungs pour into it great quantities of carbonic acid, watery vapor, and worn out matter; insensible perspiration loads it with animal excretions; exhalations from the body and dust from everywhere increase its baneful power. This air, surcharged with the seeds of death, enters the lungs by respiration, sapping the foundations of life by poisoning the blood; it is absorbed into the walls and ceilings, whence it is given back to the air, causing the offensive odors so prevalent in all ill ventilated school rooms.

The aim of ventilation is to furnish a constant supply of fresh air and to draw off foul air from all parts of the room, removing the products of respiration and exhalation as soon as thrown off, leaving no corners stagnant or unswept by the purifying current. The primary means of accomplishing this are the windows, which must extend near the ceiling, so that air entering by them may blow upon and carry away the organic dust and condensed vapor which collect and putrify upon its surface.

The windows should be numerous, the sash so arranged as to be easily handled and so placed as to admit an abundance of air, and, most important of all, they must be frequently opened. Nothing can take the place of aeration by open windows. Artificial ventilation, although indispensable for changing the air when the windows are necessarily closed, at the best is insufficient. The room must be frequently and thoroughly refreshed and purified by the sweep of the free winds through all its widely opened windows. Such an atmospheric washing should be secured three or four times a day in all weathers. At recess, particularly, it should be insisted upon, banishing teacher and pupils from the room meanwhile, if necessary.

The brightness of the remaining hours will more than make up for the

trouble and loss of time. Morning and evening the process should be repeated. In study hours windows can rarely be opened without subjecting pupils to dangerous exposure, and other means must be provided for drawing off respired and vitiated air, and supplying a constant inflow of untainted air. Outflow and inflow are inseparably connected. Neither one can be secured without the other. As the gases that are poured into the air of the school room by respiration from the lungs and exhalation from the body are, in the main, heavier than atmospheric air, their tendency is to settle, and ventilating flues should therefore open near the door.

It is worth while to recall the fact that the movement of atmospheric currents is caused by difference of weight, which in turn is the result of difference in temperature. Flues built into walls without provision for warming them are simply useless. They can neither "draw" off, nor "suck" up the deleterious vapors of the room. The action of air in a shaft or chimney, whether warmed or not, is precisely analogous to the movement of two boys balanced on a see-saw. If their weight is equal, neither moves; if one is heavier, one descends and the other ascends. So with ventilating shafts; the column of air in them is balanced against a column of the same size and height outside of them. If the outer air be cold and that in the shaft is warm, the latter column will be slightly lighter. This difference of weight, if there be not too much friction in the shaft or chimney to be overcome, will turn the balance and the air in the shaft will rise, cold air pressing in to take its place. How slight this moving force is may be seen from the fact that a column of air one foot square and thirty feet high, at a temperature of 100 degrees Fahrenheit, differs in weight from an equal volume at 32 degrees Fahrenheit by only five ounces. Taking from this the friction of both currents, ascending and descending, will give the measure of the ascensive force. Slight as this force is, it is all there is to depend on. It is obvious that all air ducts should be smooth and as straight as possible. Every angle and elbow increases the friction, and so obstructs the free passage of air. Let it be remembered that the movement of the balance depends wholly on the freedom of action of both its sides. The heated column has no force to spare for "sucking" in cold air through insufficient openings, to supply the place

which it leaves. Still less has it the power of going off by itself, leaving a vacuum behind. Unless cold air is ready in equal measure to supply the place, the warmer column will wait for it, — in other words stagnate, — and there will be no draught.

That this is the condition of many ventilating flues may be shown by holding a light handkerchief, or burning a match before them. On the other hand, fresh air can be brought into the room only by providing for the escape of foul air. An attempt to blow into a bottle will show this, and will also show why it often happens that rooms cannot be warmed from hot-air furnaces until a window or other outlet is opened, allowing the pent-up atmosphere to escape and the fresh supply to enter in its place. In order then that there may be a flow of air through a room, both inlet and outlet channels must be large, straight and smooth, thus reducing the friction of air upon the surfaces of both ducts to a *minimum*. One large flue is better than two small ones. Friction varies as the surface of the conductor. A ventilating duct two feet square exposes eight square feet of its surface to each four cubic feet of air moved through it; whereas, four ducts having equivalent cross-section capacity would expose sixteen square feet of surface to friction for each four cubic feet of air moved. A shaft two feet in diameter will conduct about the same amount of air as six shafts, each one foot in diameter. For country schoolhouses, and others warmed by stoves, flues may be built into the walls, reaching to a ventilator in the roof; but these, to be effective must be warmed in some way. Heat enough will be radiated from a large kerosene lamp placed in the opening to a foul air duct to cause an upward flow of air. But an open fireplace is the best of all ventilators for this class of buildings. An open fire causes an immediate upward current of cold air through the chimney. This exhaustion of cold air from the lower strata, in turn causes the warmer air from the ceiling to descend, warming the floor and equalizing the temperature of all parts of the room. This open fire, if kept burning till the walls of the chimney are heated will cause the upward current of air to continue long after the fire is burned out, if fresh air is supplied to take its place. This fresh air may be admitted through an opening in the outside wall, and conducted under the floor by a tin or wooden pipe to the stove, into a chamber or jacket that incloses the bottom

and reaches half way up the sides of the stove. This jacket should be made of galvanized iron. Ventilating stoves, of which many kinds are manufactured, accomplish the same end economically and thoroughly. The practical difficulty with these ventilating stoves is that they send the warm air up to the ceiling, and the lower part of the room must wait until the upper regions are completely filled before it is affected by the warmth. This difficulty is overcome by an open fire, which, by its powerful draught, immediately sets up a circulation from the upper to the lower strata. These upward and downward currents commingle and so equalize the temperature of all parts of the room.

Direct radiation from an open fire, by warming the floor and the lower strata of air first, is a thoroughly reliable factor in producing uniformity of temperature throughout the room.

Fresh air may be admitted from the outside through an open window, even in study hours, when the current comes from behind the stove so that the incoming air must pass it before reaching the pupils. Even then it is better to place a board on the window-sill, directly under the lower sash, and into this to insert two six-inch elbows, furnished with dampers, and so placed that the incoming current of air shall have an upward direction. The momentum of this current will carry it far toward the ceiling, and its temperature will be raised by the air of the room before it reaches the floor. Heating with an air-tight stove, baking the bodies and brains of children in an unchanged atmosphere, that reeks with carbonic acid and organic exhalations, may save fuel, but it wastes life. In fact, however, there is economy in wise ventilation. The sluggishness that is caused by breathing impure air is attended with a sense of chilliness even at high temperatures.

Furniture.

The size and shape of a school-room determines the arrangement of its furniture. Every school-room should be large enough for the personal accommodation of the teacher, and for purposes of recitation. It should also be sufficiently large to furnish each pupil with space enough for a desk, and for free and unobstructed movement. Every child has a right to his own personality and his own share of uncontaminated air. The addition of two or three feet to the length and breadth of a school-room adds little to the expense, but adds much

to the comfort and convenience of pupils and teacher. In adaptation to the needs of the school-room, the best school furniture leaves little to be desired, and the best will in the end be found to be the cheapest. Great care should be taken to adapt the height of seats and desks to the size of the children who occupy them. Some seats should be furnished for every ungraded school so low that the youngest pupils may occupy them and still rest the feet squarely on the floor; and others so high, that the larger pupils may use them without discomfort. It is important, also, that the pupils' desks be brought so near the seats that they may use them in writing or in slate work, and still maintain upright positions.

Folding seats allow the forward edge of the seat to be placed directly under the edge of the desk in front, and, when folded, leave room for pupils to pass in or out. For this reason, and to economize space as well, desks with folding seats are preferable. Single are better than double desks, for many reasons. Double desks make possible the spread of vermin and disease, and the contamination of the pure by contact and close relationship with immoral seat mates. The amount of genuine study is lessened and the need of discipline is increased by compelling children to sit together at the same desk. The necessary noise of the school room is augmented, the temptations to carry on visitations in study hours are multiplied, and orderly habits are broken up, by this means.

Every school room ought to be a place for the formation of correct business habits. Every pupil should be held responsible for the proper care of his own seat and desk, for the neat and orderly arrangement of his own books and papers, and for rigid abstinence from interference with the books or papers of another. All this is impossible, or nearly so, where two share one desk. To divide responsibility is to weaken and destroy it.

Many things essential to the comfort and efficiency of schools are sometimes overlooked by districts. Mention may be made of the following essential things. Walks and steps should be supplied with foot scrapers. Strips of band iron, securely fastened to one step, projecting half an inch above the surface of the tread, make excellent and economical scrapers. Every outside door should be provided with one or more coarse mats, metallic, rubber or cocoa,

andthe inside doors with finer ones. A good clock placed in plain sight of the whole school is a valuable addition to school furniture. System in school operations depends upon the proper observance of time, and accuracy and ease in the movement of classes are more readily secured when each pupil knows when his division or class is to recite.

Plans of School Houses.

The following electrotypes have been made after plans prepared under the supervision of the department officers; some of them especially for the purposes of this circular, and others have been selected from the portfolios of architects of repute, who worked them out and wrought them into forms in different sections of the country. Some houses represented in this circular have had the approval of school officers after actual use for a series of years.

The plans herewith submitted may, in certain cases, need modifications to adapt them to local wants, but it is urged that the important features of these designs be preserved. Floor space should be sufficient to allow ample passage ways for pupils, and to enable teachers to handle and interchange classes without confusion and without jostling.

Provisions for lighting, warming and ventilating rooms should never be stinted. All stairways should be covered, and inside ascents should be by easy flights having a "run," or, better still, a "return" in the middle.

Schoolhouse stairs should have twelve, or, at the least, eleven-inch treads, and six, or, at the most, seven-inch risers.

Local builders may obtain additional information relating to these plans by corresponding with the architects who furnished them. Their names and addresses will be found at the close of this circular.

To aid in determining the necessary size of schoolrooms, a table showing the dimensions of the various sizes of school desks, is here inserted.

SINGLE DESKS.						GRADE.	DOUBLE DESKS.					
Size.	Height of Seat.	Width of Top.	Length.	Floor Space.	Age Accommodated.		Size.	Height of Seat.	Width of Top.	Length.	Floor Space.	Age Accommodated.
A	16	16	24	33	Adults.	..... Normal.....	A	16	16	40	33	Adults.
B	15	15	24	31	17 to 20	... High School...	B	15	15	40	31	17 to 20
C	14	14	21	27	13 to 17	.Grammar School.	C	14	14	38	27	13 to 17
D	13	13	21	27	10 to 13	.1st Intermediate.	D	13	13	38	27	10 to 13
E	12	12	18	26	7 to 10	.2nd Intermediate.	E	12	12	36	26	7 to 10
F	11	12	18	26	5 to 7	. ... .Primary.....	F	11	12	36	26	5 to 7

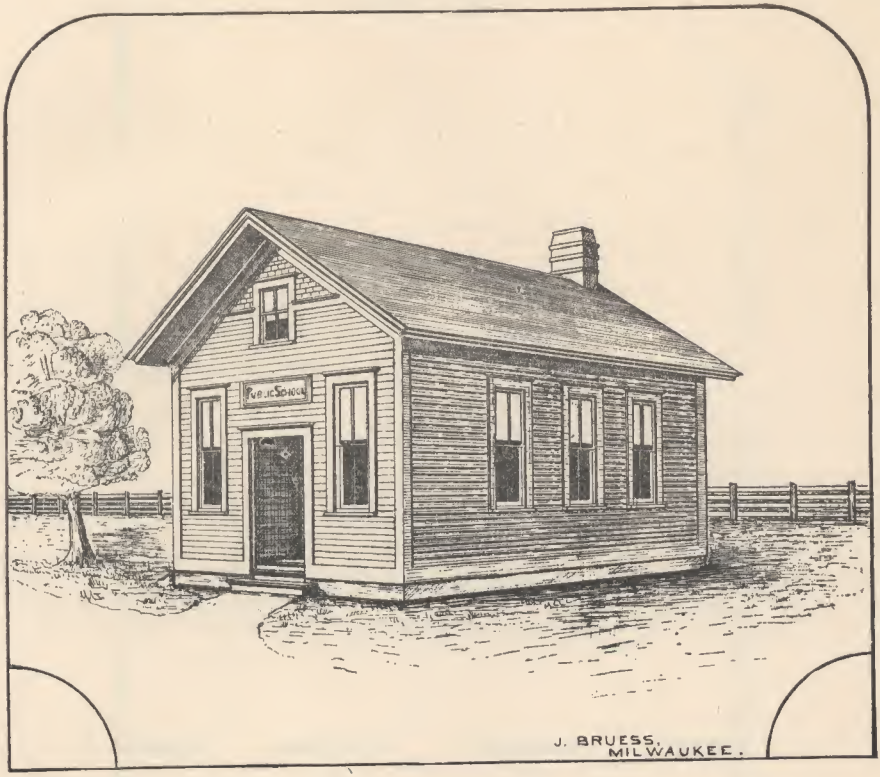
Country districts will rarely or never need larger desks than those that are marked in this list "C." Ordinarily the desks of country schoolhouses will be well chosen if one-third of them be of the size marked "C," one-third of the size marked "D," and the remainder be divided between those marked "E" and those marked "F." The larger desks should be placed at the rear of the row of forms, the medium sizes in the middle and the smallest in front. The front row of desks should have no seats attached, thus affording an opportunity to place recitation seats in front of the row of forms. The aisles between the desks should be twenty inches, measured from the extreme edge of one top to that of another. The side aisles should be at least thirty inches in the clear, and, where it is practicable, a center aisle of the same width should be left. Where space permits, three feet may be allowed for side aisles. The list will enable mechanics to estimate the seating capacity of a room, if they remember that the words "floor space" in the list mean the distance from the back of one seat to the back of another.

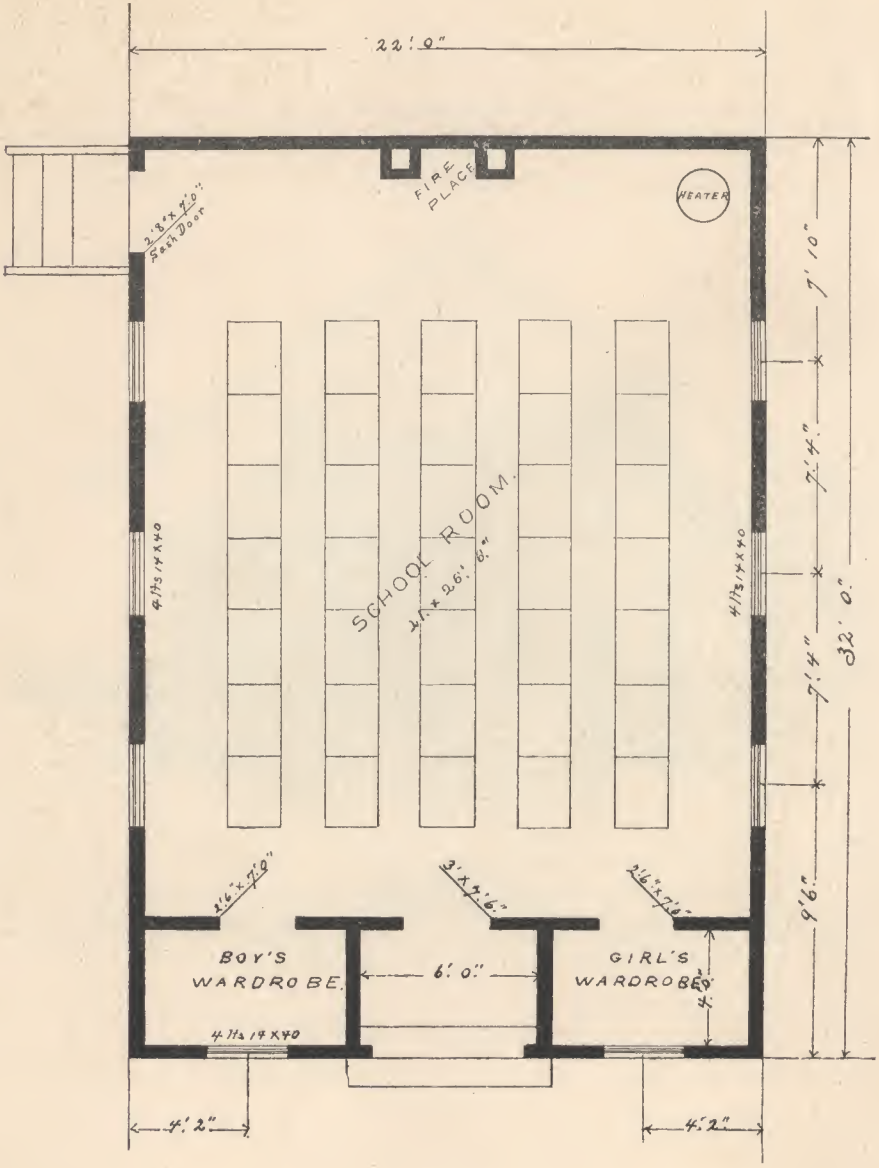
One Room School Houses.

These plans are designed to aid those country and village districts that can ill-afford to employ an architect. It is hoped that they offer valuable suggestions, and will help districts to furnish schoolhouses that are better lighted, better warmed and ventilated, and that will furnish better conveniences for pupils and teachers than are ordinarily found in one-room school buildings.

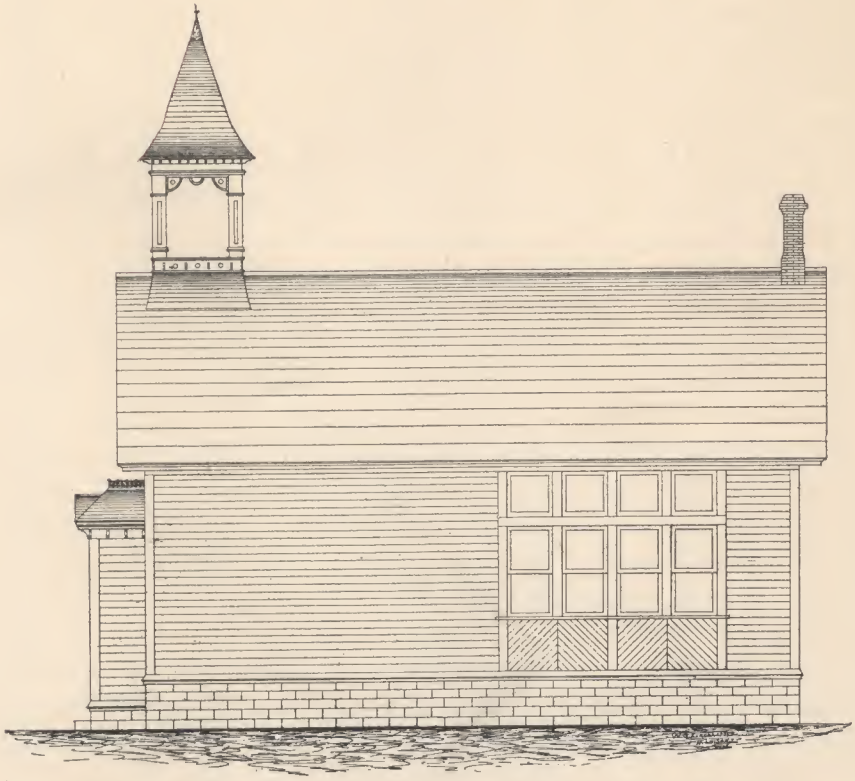
They will accommodate from 35 to 75 pupils, and may be built at a cost varying from $500 to $1,200. The first cut, from designs by J. Bruess, of Milwaukee, gives the front elevation, a perspective view, and the floor plan of a plain building, designed for country districts. The style is simple and inexpensive. A small fireplace, designed to aid in ventilating the room, and a sash door, giving egress to the boys' play ground, are shown in the floor plan. The room should be warmed by a ventilating stove which is supplied with pure air by a flue leading from the outside under the floor, and through an opening in the floor under the stove to a hot air chamber. Blackboards of suitable width should extend along the entire end opposite the entrance, and along either side to the first window. They may be extended across all the spaces between windows. The teacher's table is at the rear of the room, and the pupils sit with their backs to the entrance.

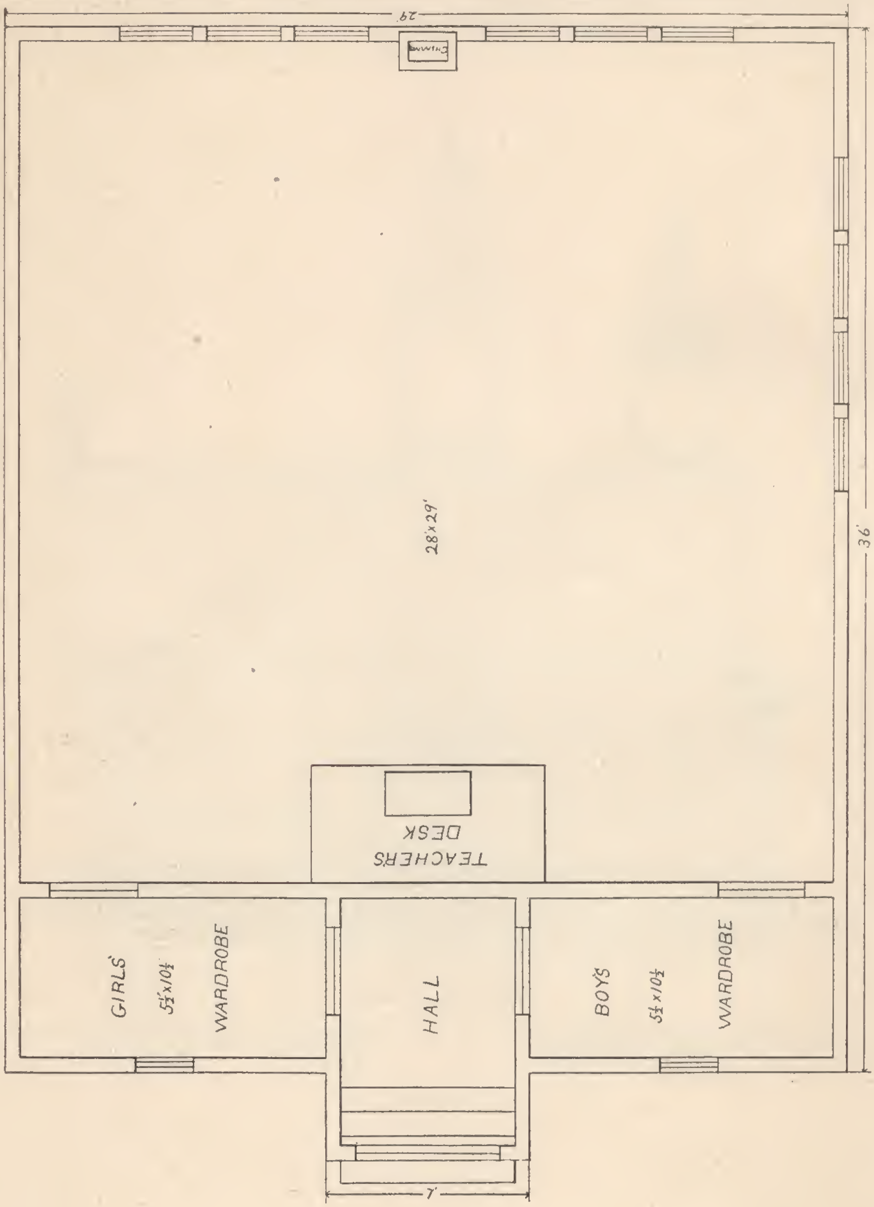
FRONT ELEVATION


J. BRUESS,
MILWAUKEE.


22' 0"
FIRE PLACE
HEATER
2'8"x7'0" South Door
4 1/2 x 14 x 40
SCHOOL ROOM.
40' x 26' 8"
4 1/2 x 14 x 40
7' 10"
7' 4"
7' 4"
9' 6"
32' 0"
2'6"x7'0"
3'x3'6"
2'6"x7'0"
BOY'S WARDROBE.
6' 0"
GIRL'S WARDROBE.
4 1/2 x 14 x 40
4' 2"
4' 2"

Plan No. 2, adapted by W. G. Kirchoffer, of Elkhorn, Wis., presents the floor plan, the front and side elevations of a one room schoolhouse, built on the high school grounds at Sparta, Wis. The entrance is lighted by a transom window over the front doors, and the wardrobes by high, small windows, as shown in the cut. The school room is lighted by windows in the rear, and on one side of the building. One side of the building is without windows, leaving an entire wall to be occupied with blackboards. This blank wall will be an undesirable feature where a house must be so placed that both sides are exposed to view. This may be remedied by building both sides of the house alike, leaving the rear wall blank, reversing the pupils' desks, and placing the teacher's table and the blackboards at the end opposite the entrance. It will be noticed that the only entrance to the school room is through the wardrobes. A better arrangement may be effected by placing the teacher's table and platform, if a platform be thought desirable, at one side of the center of the front end of the room, and inserting a door between the hall and the main room.

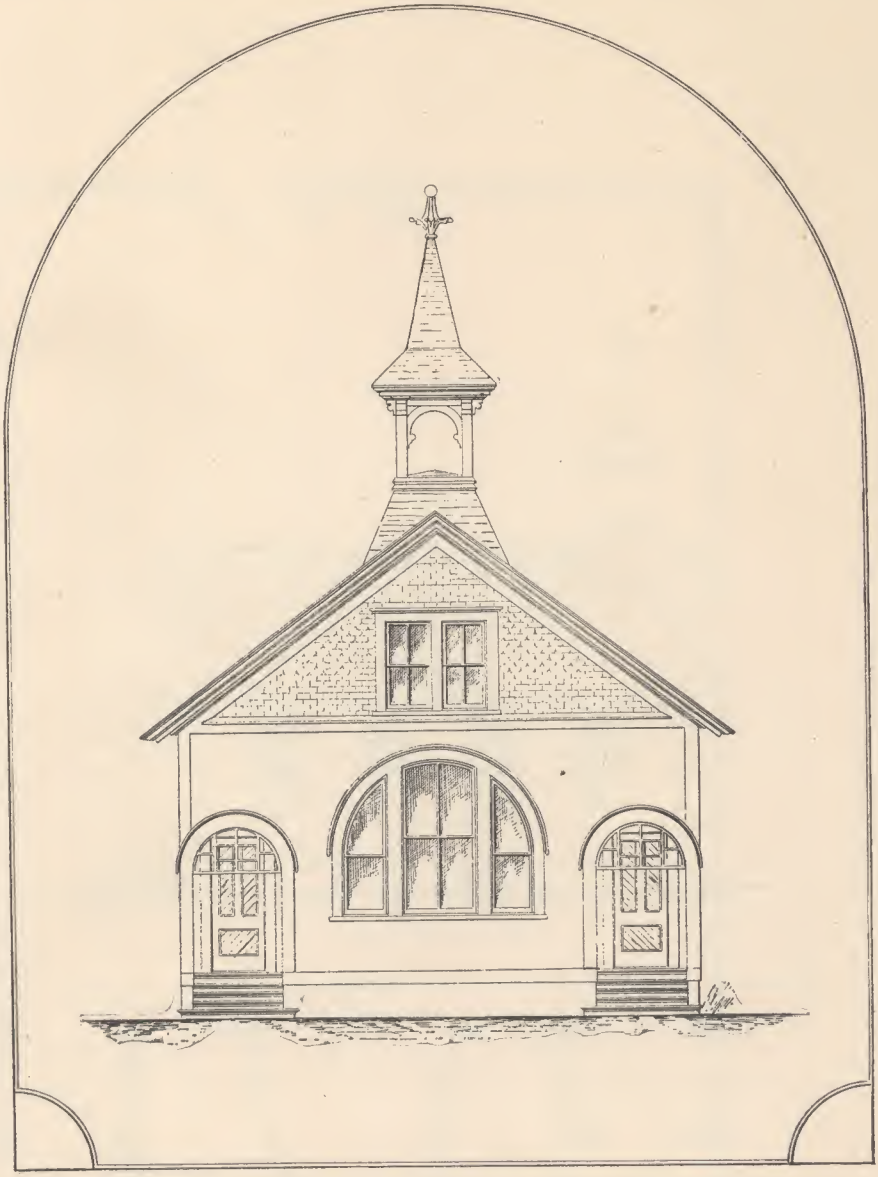


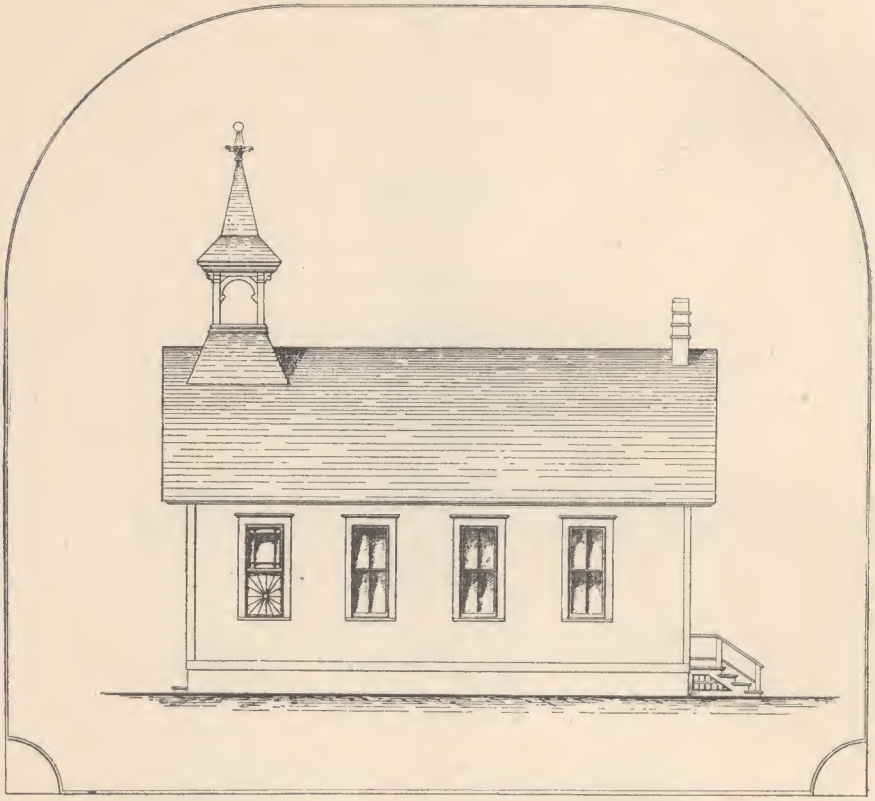

29'
Chimney
28'x29'
36'
TEACHER'S
DESK
GIRLS'
5½'x10½'
WARDROBE
HALL
BOYS'
5½'x10½'
WARDROBE
7'

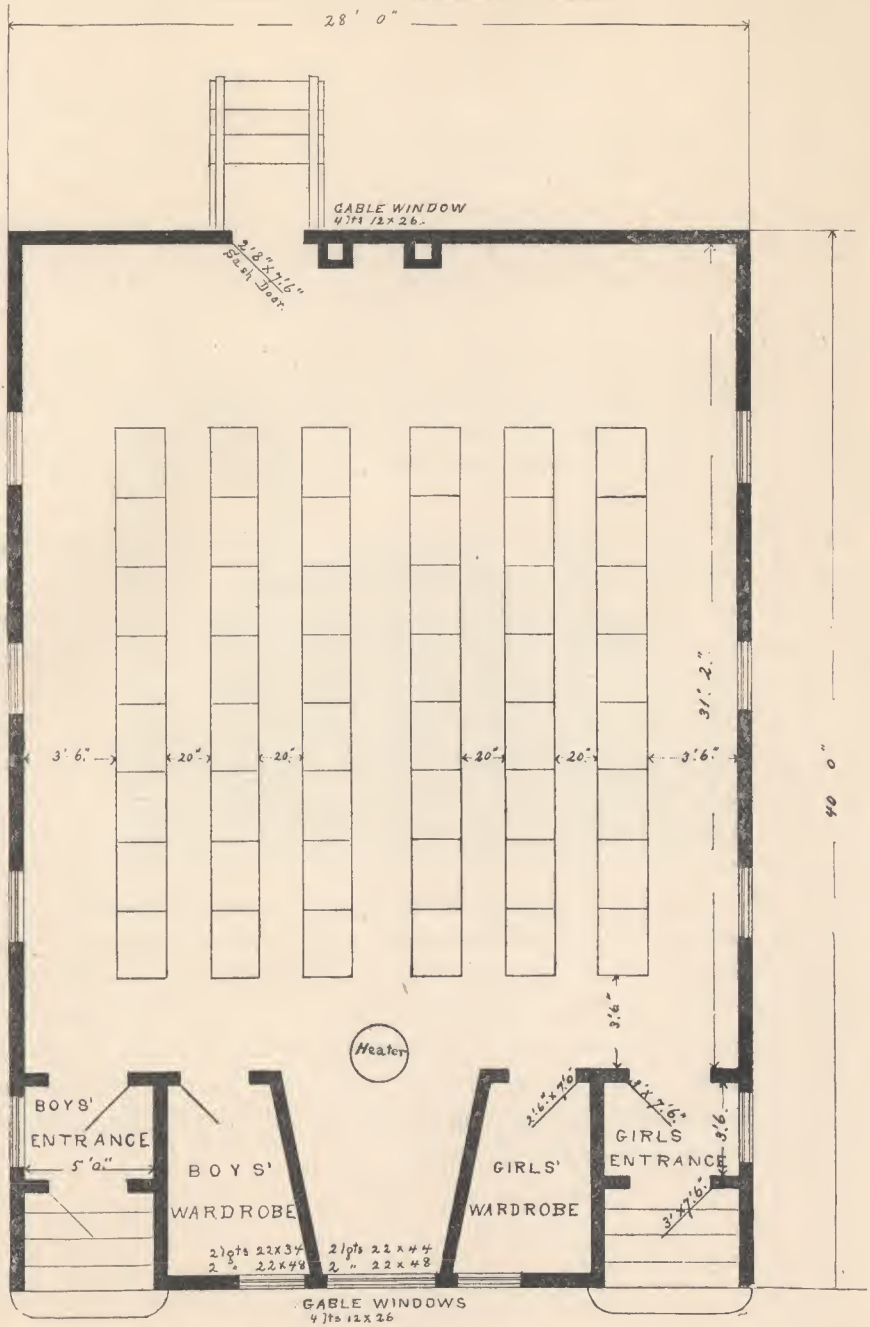
The next diagrams present front and side elevations and floor plans of a schoolhouse drawn from designs furnished by this office. It will easily seat 48 pupils in single, or 64 in double desks. More may be seated by narrowing the aisles; but these open spaces are invaluable sources of pure air. The plan is drawn for 48 single desks, arranged in six rows; for side aisles, three and one-half feet wide; for passage-ways between the desks, twenty inches between the extreme edges of the desk tops, and a center aisle thirty inches in width. Blackboards extend across the end and on the sides to the first windows. It is well to fill all the spaces between the windows on the sides of the room with blackboards of suitable width. A sash door on one side of the fireplace affords an opportunity to overlook the boys' playground, and ready access to a woodhouse in the rear. A tight board fence, six or eight feet high, extending from the woodhouse to the rear of the lot, should divide the boys' from the girls' play ground. Separate entrances are provided, and all but one of the steps leading to the landing are within the house. The partitions enclosing wardrobes, and dividing them and the entrances from the main room, should be about seven feet high, of matched hardwood boards finished in oil, with base board and cornice. This arrangement adds more than one thousand cubic feet to the reservoir whence air is to be drawn for respiration, and affords excellent means for admitting fresh air. By closing entrance and wardrobe doors and opening wardrobe windows the cool air from the outside will be warmed, as it passes over the partition, by contact with the heated air of the upper portions of the room. Between the wardrobes a recess, reaching to the front window, affords space for library cases and for a dictionary table. In front of this recess stands the heater, a ventilating stove to be supplied with fresh air by the process outlined under cut No. 1. The stovepipe, leading to the chimney in the opposite end of the room, should be suspended as near the ceiling as safety will permit, and should be shielded on the lower side by a half-round of tin to prevent the downward radiation of heat. Between the stove and the desks a screen, panelled with zinc, hinged like a clothes-horse and made stable by large feet of hard wood, should be placed. Two desks nearest the heater, as shown in the diagram, may be omitted when the pupils can be seated without them. The fireplace is invaluable as a means of ventilation. It may be re-

peated: that a constant supply of fresh air can be obtained only where provision is made for a steady outflow. A ventilating stove can neither "suck" nor "draw" more than the normal amount of air into a closed room. All air movements are caused by the inequality of weight in the several strata, and this is the result of difference in temperature. The air in contact with a heated surface is expanded and rises to the ceiling, and this process goes on until the lower strata are warmed by contact with those above. It is evident that before the floor can be comfortably warmed, the upper portions must be intensely heated. Any process that will bring this warm air in constant flow to the region where pupils sit, will be not only life-giving, but money-saving. When a fire is kindled in an open fireplace, the column of air in the chimney is rarified and is forced upward by a current of cooler, and hence heavier air from the floor. Warm air from above descends to take its place, and fresh air from out of doors flows through the hot-air chamber of the ventilating stove into the reservoir thus created for it. The circuit is complete, and provision is made for bringing warmth into the region where pupils sit, for supplying fresh and removing vitiated air; but it was the open fire that started the current. The current thus started by a fire kindled in the morning will continue long after the fier is extinct.

Comfort and economy will be subserved by lining schoolhouse floors with softwood boards, but the floor itself should be made of narrow strips of hardwood, matched and finished in oil.



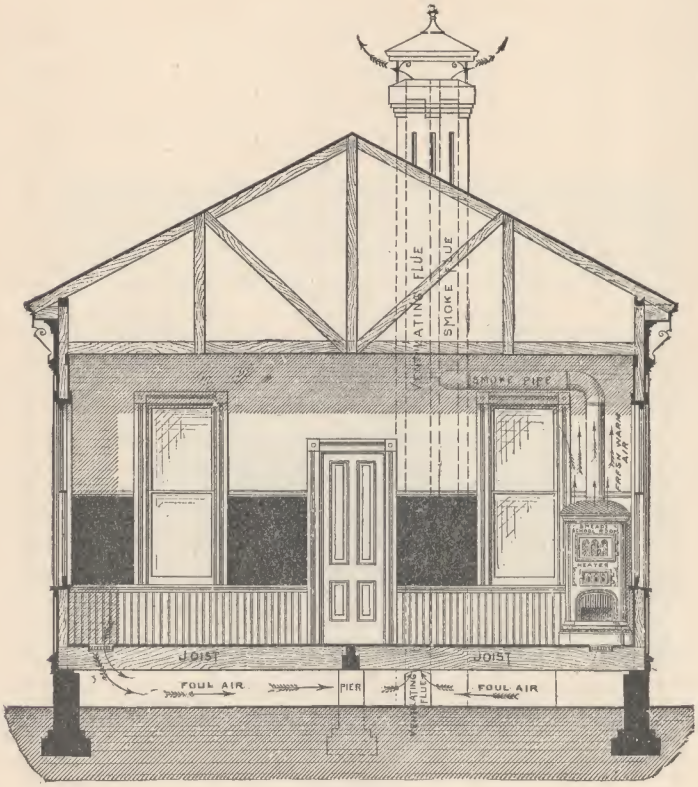



28' 0"
GABLE WINDOW
4 lts 12 x 26.
2'8" x 7'6"
Sash Door.
3' 6"
20"
20"
20"
20"
3' 6"
31' 2"
40' 0"
3'6"
Heater
BOYS'
ENTRANCE
5' 0"
BOY'S
WARDROBE
GIRLS'
WARDROBE
GIRLS
ENTRANCE
3'6"
2'6" x 7'6"
3' x 7'6"
2 lgts 22 x 34
2 " 22 x 48
2 lgts 22 x 44
2 " 22 x 48
GABLE WINDOWS
4 lts 12 x 26

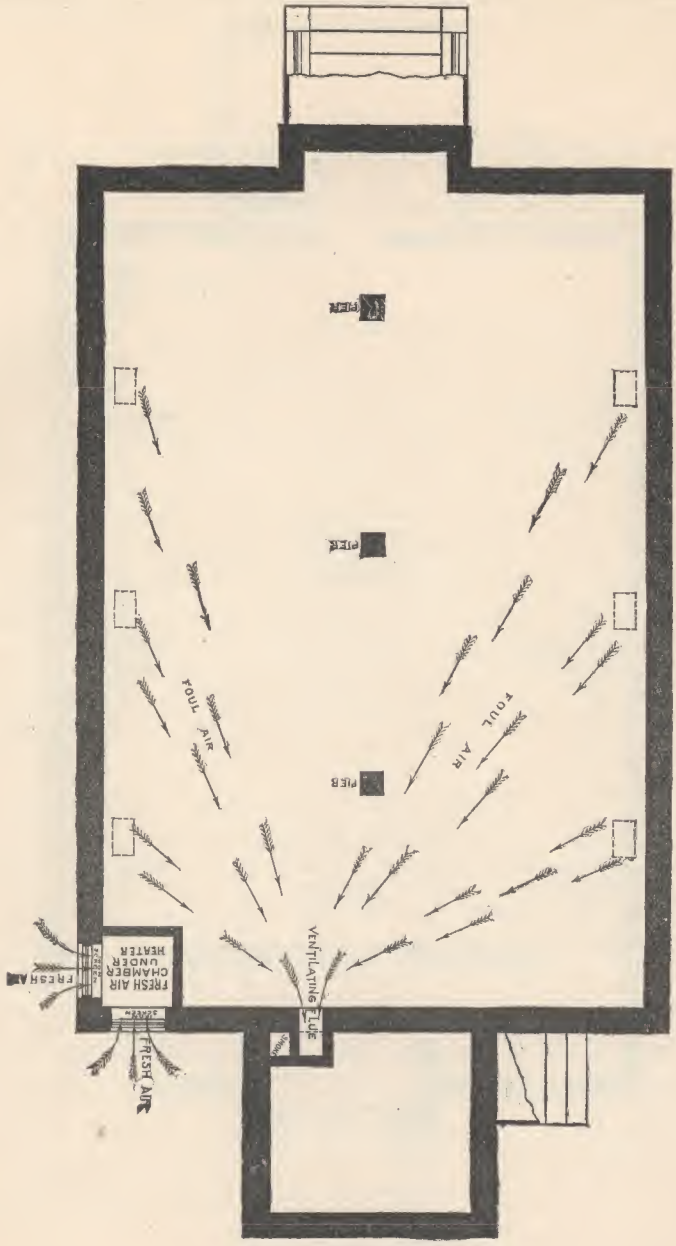
T he fourth design is taken from the circular issued by Superintendent Whitford, in 1882. It gives a perspective view, a cross section, basement and floor plans of a one-room building, drawn by Messrs. Edbrooke and Burnham, architects, Chicago. "The size of the main building is 24½ by 36 feet, and it is 13 feet between joists. The wood-house is 8½ by 11¾ feet, and its height is 10 feet between joists. The floor surface of the wardrobes, each 5 by 8½ feet, is 85 square feet; and of the school-room, 23 by 29 feet, is 667 square feet. It furnishes ample space for forty-two pupils at double desks, and it can well accommodate thirty-six at single desks. For each of the former number of pupils, the school-room provides nearly 16 square feet of floor, and fully 206 cubic feet of air; and for the latter number, 18½ square feet of floor, and 240.8 cubic feet of air. The area of the windows in this room is equal to almost one-fourth of its floor surface.

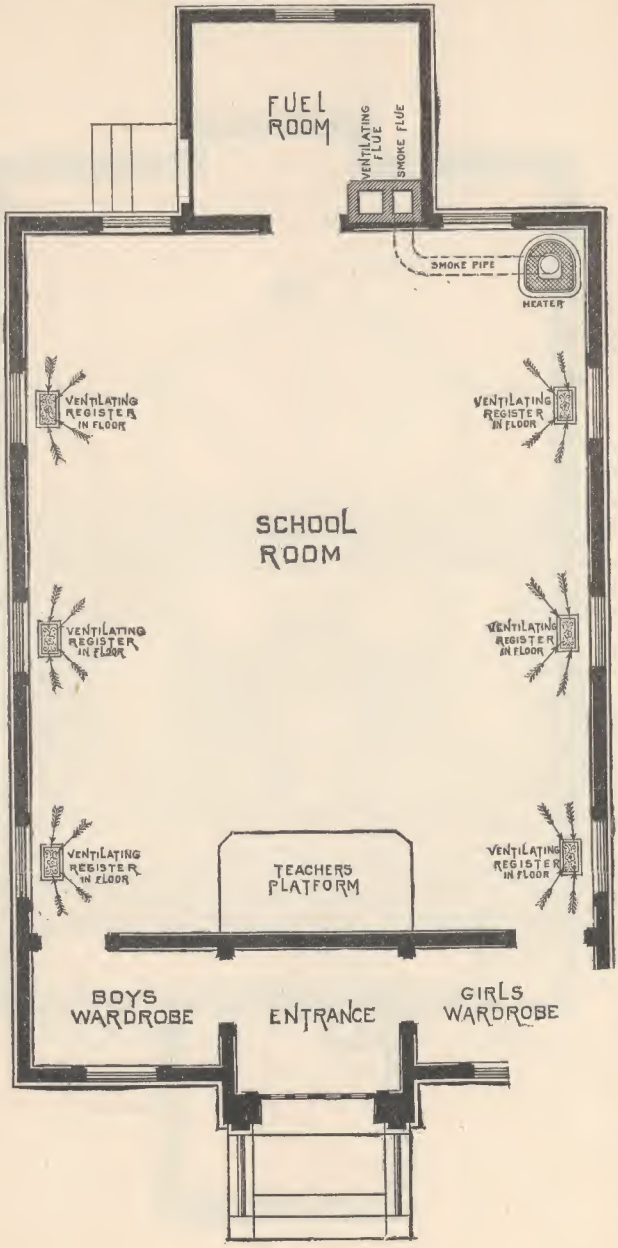
"The main feature of this building consists in the superior facilities for warming and ventilating the schoolroom. The fresh air, after entering the air-chamber through the openings in the outside walls under the joists, passes another opening, at least 20 by 22 inches in size, into one of Smead's school-room heaters, where it is warmed to about 120 degrees on an average. It then is driven into the room in the volume already mentioned and distributed throughout in course of thirty minutes. It is afterwards withdrawn, as it descends to the floor, first, in part by the draft of the heater; and second, through the registers and under the floor, and then into the ventilating flue in the chimney. Three forces are always operating in cold weather to drive the foul air through these registers, viz.: the expansive power given by the heater to the air as it enters the room; the condensation of the air as it cools rapidly in contact with the windows, where it drops immediately into the registers beneath; and the exhaustion created in the ventilating flue by the heat derived from the smoke escaping through another flue in the chimney. If desired, a cheaper device in the form of a cast-iron ventilating base can be placed in the wall next to the floor under each window of the room, in the place of the register, as shown on the floor plan."


PUBLIC SCHOOL
EDBROOKE & BURNHAM ARCHTS CHICAGO.


VENTILATING FLUE
SMOKE FLUE
SMOKE PIPE
HEATER
JOIST
JOIST
FOUL AIR
PIER
FOUL AIR
VENTILATING FLUE

SECTION

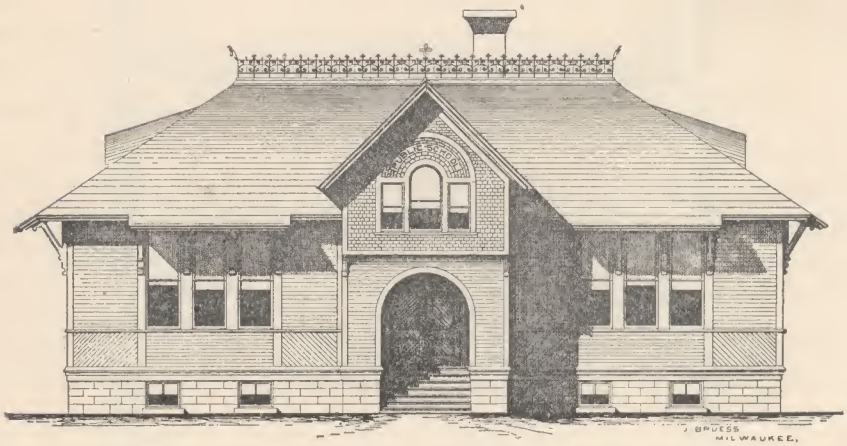

PIER
PIER
PIER
FOUL AIR
FOUL AIR
FRESH AIR CHAMBER UNDER HEATER
FRESH AIR
VENTILATING FLUE
FRESH AIR


FUEL ROOM
VENTILATING FLUE
SMOKE FLUE
SMOKE PIPE
HEATER
VENTILATING REGISTER IN FLOOR
VENTILATING REGISTER IN FLOOR
SCHOOL ROOM
VENTILATING REGISTER IN FLOOR
VENTILATING REGISTER IN FLOOR
VENTILATING REGISTER IN FLOOR
TEACHERS PLATFORM
VENTILATING REGISTER IN FLOOR
BOYS WARDROBE
ENTRANCE
GIRLS WARDROBE

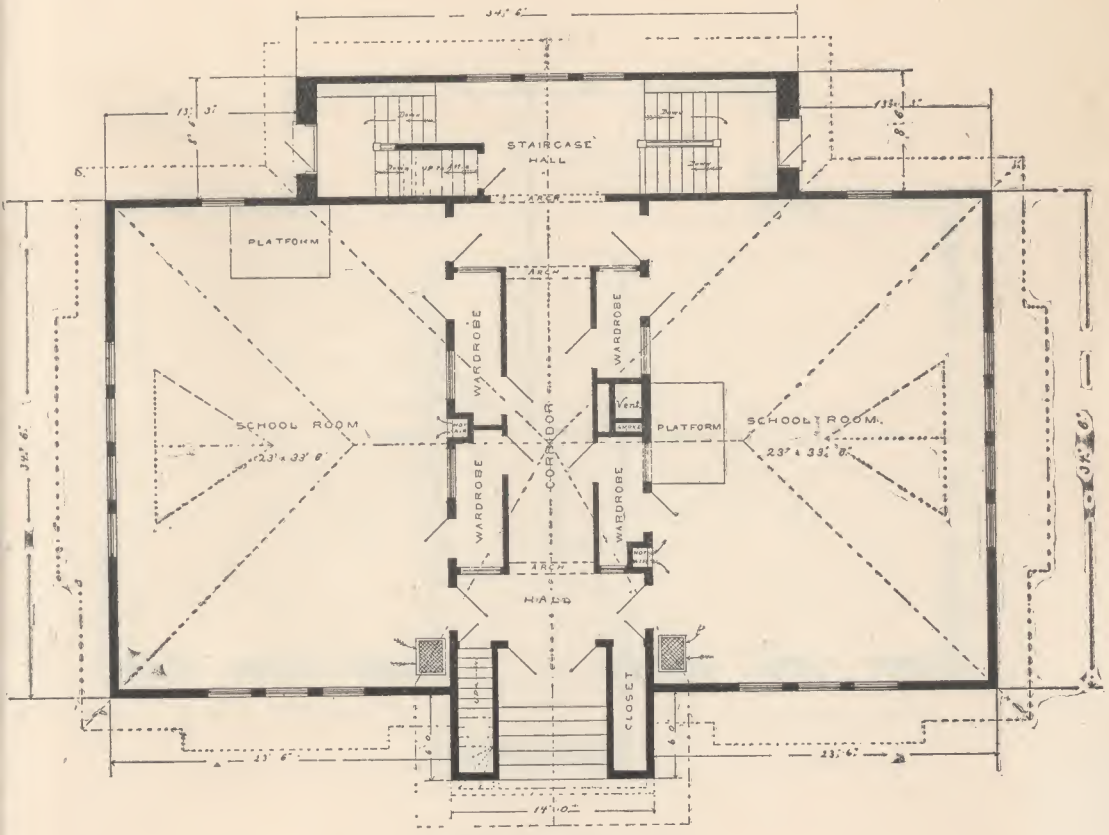
Two Room School Houses.

The succeeding diagrams give the front elevation, basement and floor plans of a two-room building, from designs by J. Bruess, of Milwaukee. It will be noticed that closets are provided for in the basement. These can be used as water closets in places where water and sewerage are supplied; or the contents of the vaults can be dessicated by currents of air drawn through the basement in the process of ventilation. Many basement privies of school houses are rendered entirely wholesome by the latter process, and many, perhaps all of the firms engaged in warming and ventilating public buildings by means of hot air, will provide for this desiccation and guarantee results. Outbuildings, used as privies, are unsightly, and, in thickly settled neighborhoods, it is nearly impossible to prevent their becoming public, as well as private nuisances. So far as practicable they should be abated in the interest of health and of decency alike.

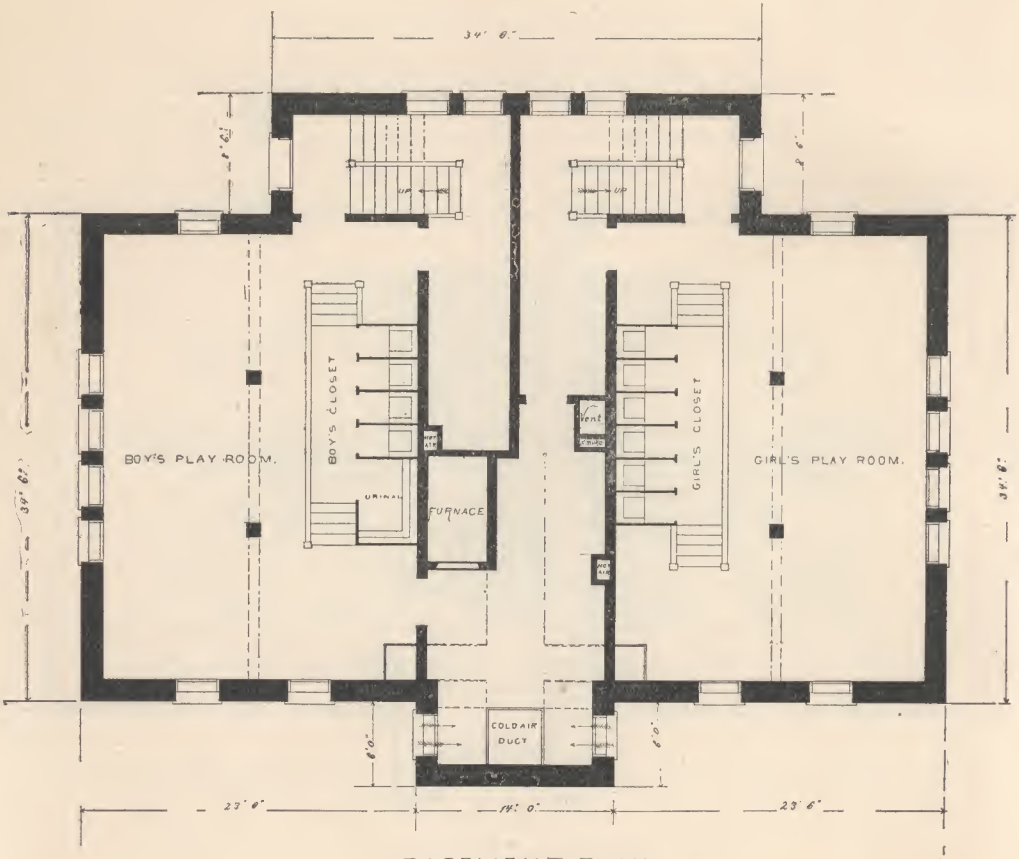
A principal's room may be finished over the entrance, to which access may be provided by a stairway placed on one side of the entrance, as shown in the cut. On the other side a closet is provided for the necessary equipments of a schoolhouse, such as brooms, maps, dust pans, etc. A flight of stairs leads from the staircase hall to the attic, and if a walk be laid across this, entrance to the principal's room may be obtained in this way also. Dormer windows are provided for the attic, and the plan is so drawn that another room may be extended from the staircase hall, without marring the harmony of the design. This additional room should be the same size and shape as those shown in the cut. The building has an attractive exterior, and is well planned for ward and village schools. The perfect adaptation of the design to a two or three-room building s an especially desirable feature.



-FRONT ELEVATION.



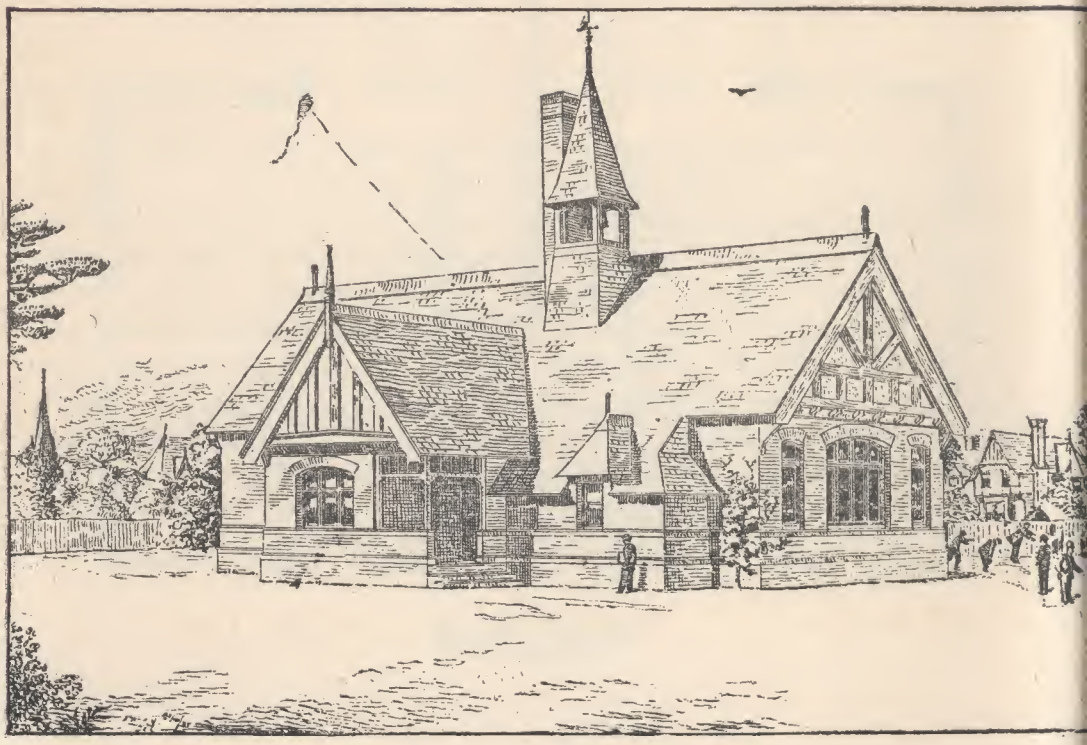
FIRST FLOOR PLAN.

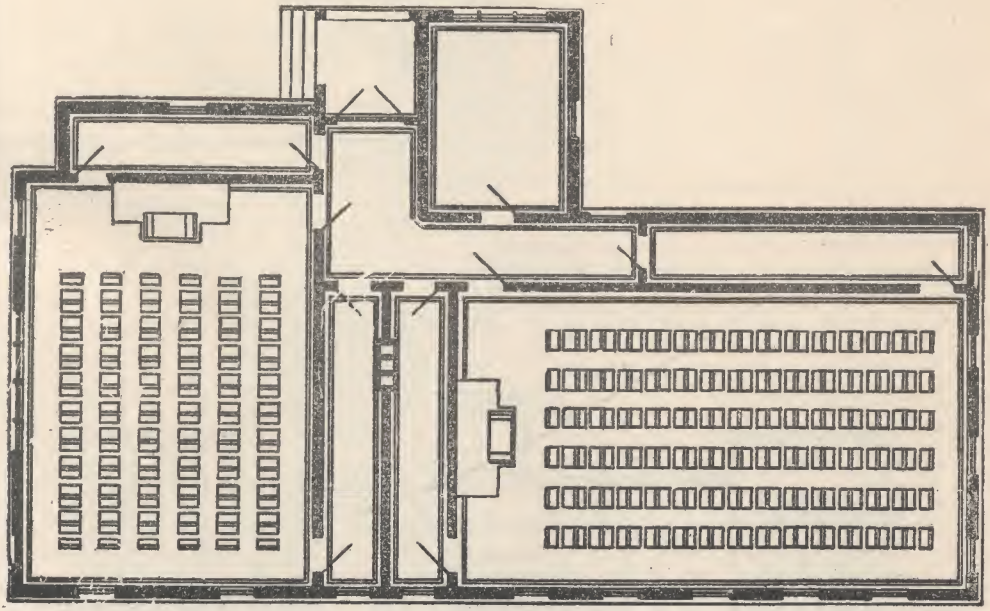


BASEMENT PLAN.

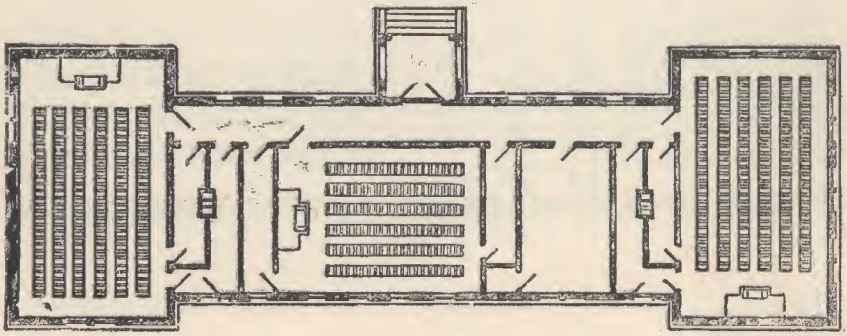
J BRUESS.
MILWAUKEE.

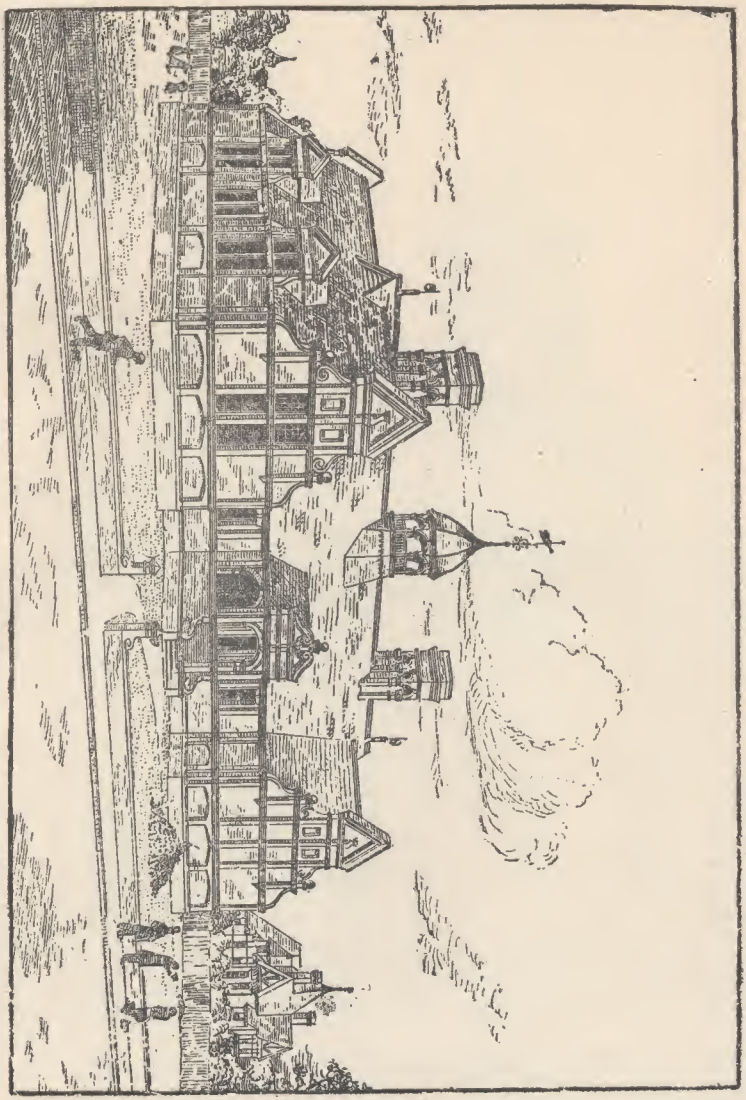
The sixth design is from the circular by Superintendent Whitford and "was prepared by H. C. Koch & Co., architects, of Milwaukee. It is for a brick building, with frame gables to imitate timber-work, having panels finished with shingles or common siding. Its entire length is 82 feet. It has only one story, and provides for the girls and boys separate wardrobes, each 5 feet in width. It has also a teacher's room, 12 by 16 feet in size, which can also be used for the recitation of classes when desired. The larger school-room is 25 by 43 feet at the floor, and will accommodate about 75 pupils; and the smaller one, 25 by 34 feet, and will accommodate about 55 pupils. The height of these rooms should be 14 feet, to increase somewhat the air space, which, with the floor surface, in this design as well as in the previous one, is not quite sufficient, even if only small children should occupy the seats furnished."



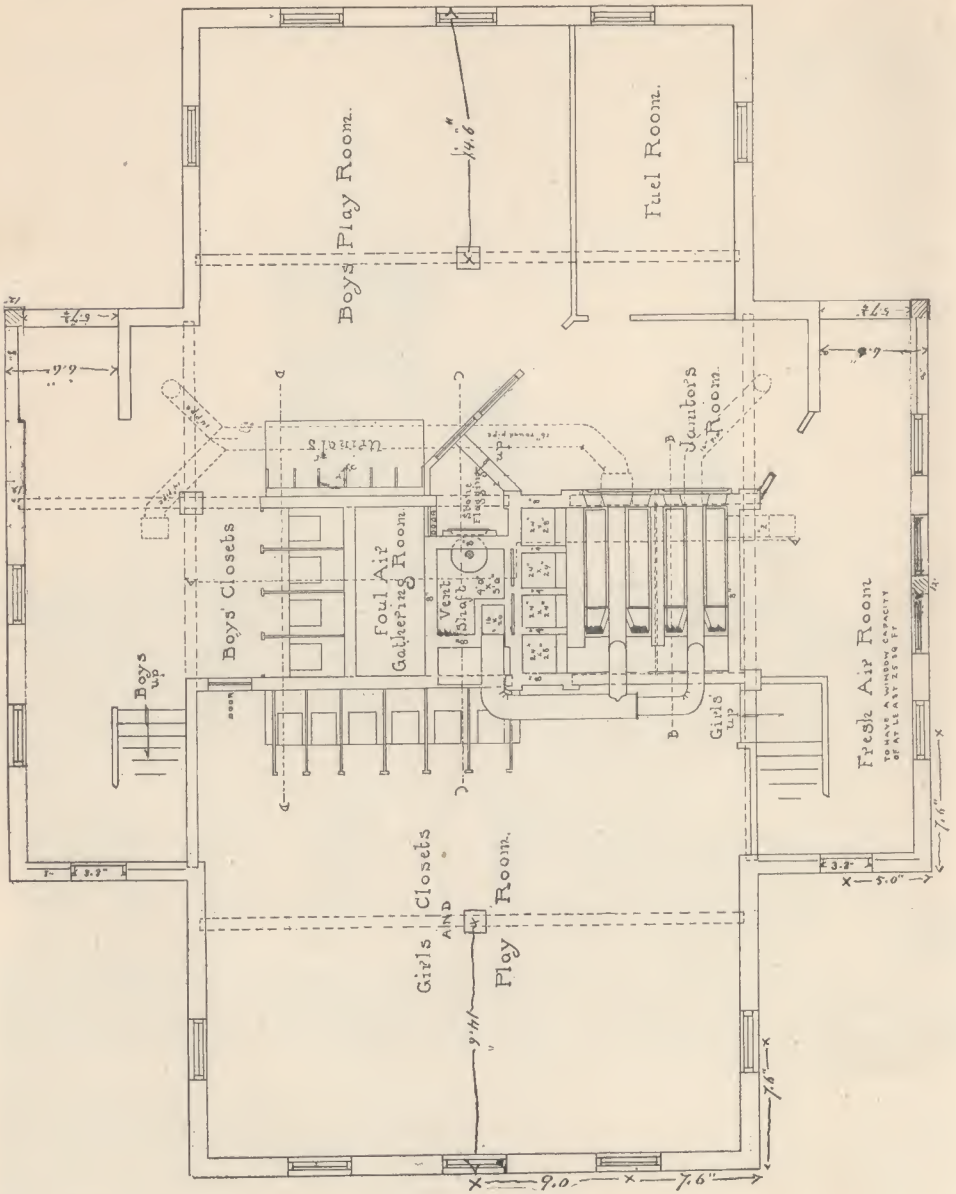


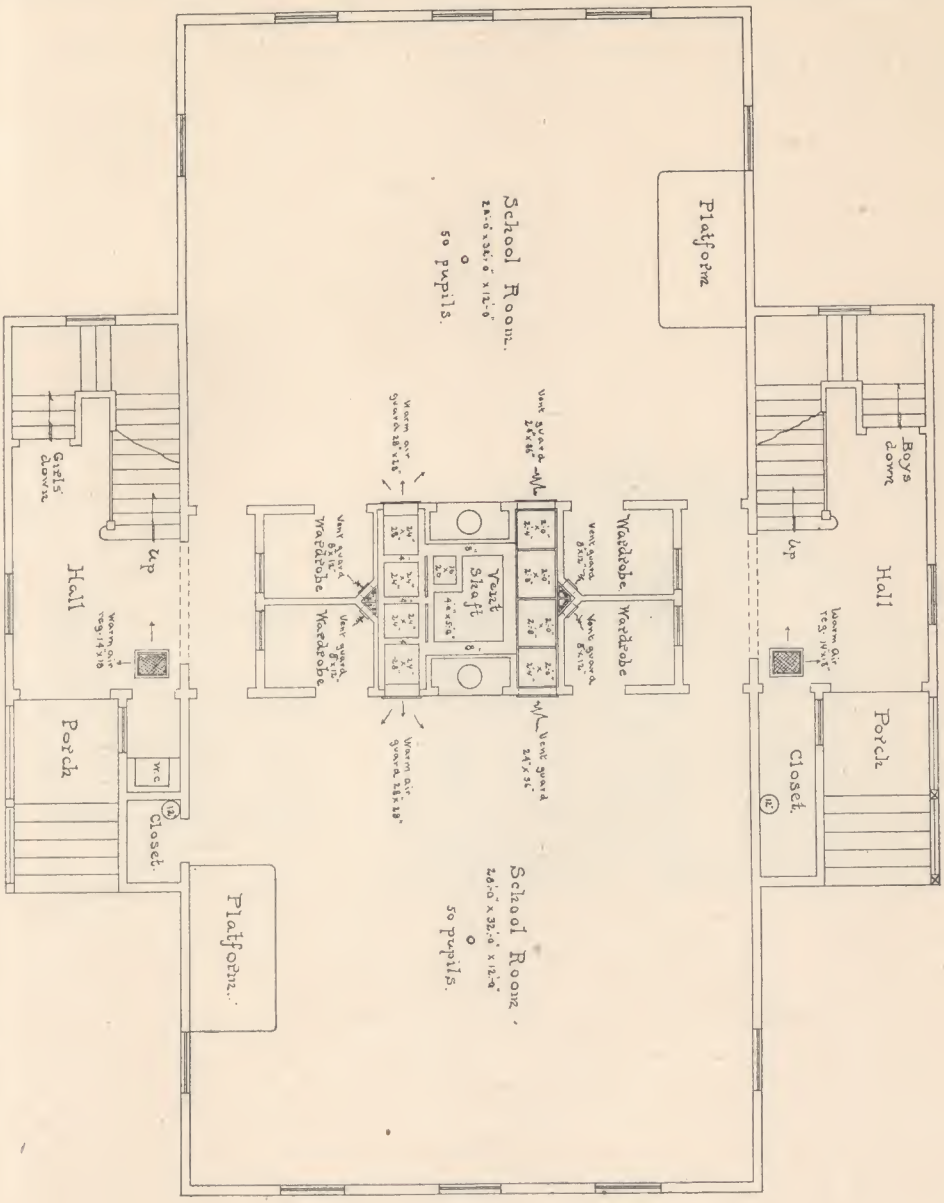
The seventh design presents a perspective view and floor plan from the same circular, from plans furnished by H. C. Koch & Co., Milwaukee. "It is for an elegant one-story school building, containing three school rooms and a teacher's room, which are connected together by a long corridor in front. Separate wardrobes for girls and boys lead from this corridor into the school rooms, and are used for the entrance and exit of the pupils. The school rooms are indicated by the rows of desks on the plan. The room shown without desks is for the principal of the school, and can be used for the recitation of classes when necessary. The central part of the building is 140 by 46 feet, and will accommodate 228 pupils in the three rooms. This design requires that the building be of brick, with a stone basement up to the line of the top of the water-table. The belts and pilasters are of brick; and the copings on gables of stone or terra cotta. This roof may be slated or shingled."



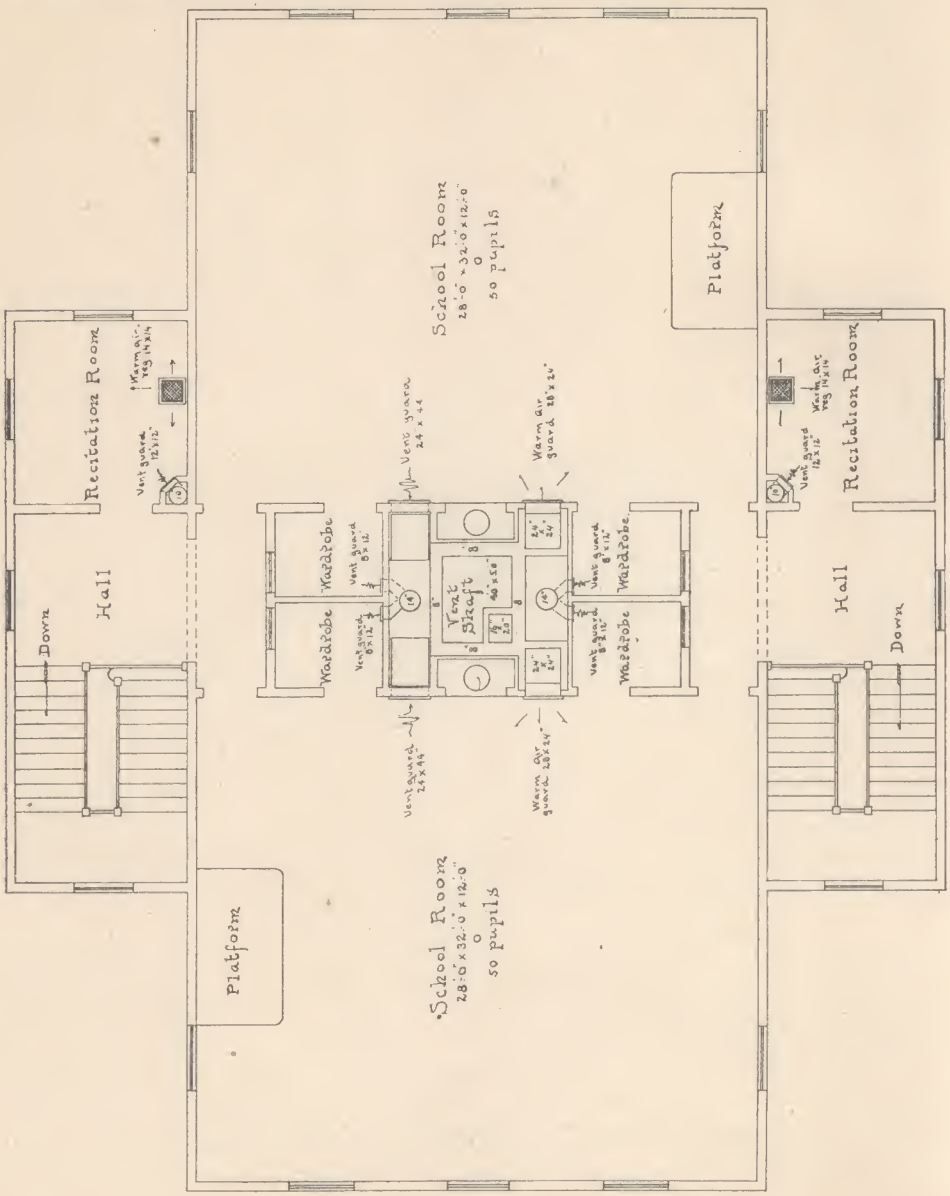


The eighth design represents a four-room school house that was built on Meader street, in Providence, R. I. The cuts present one elevation, the basement, first and second floor plans of an admirable building for a ward or villag school house. This design was commended as a model by the school commise sioner of Rhode Island, in his report for 1891.

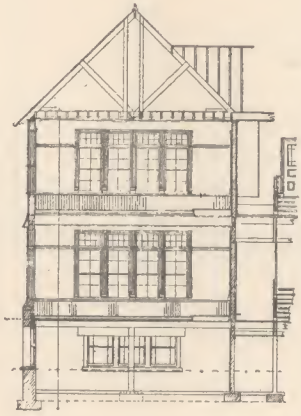

Boys' Play Room.
Fuel Room.
Janitor's Room.
Urinals
Boys' Closets
Foul Air Gathering Room
Vent Shaft
Boys up
Girls up
Fresh Air Room
Girls' Closets AND Play Room.
9.0
7.6"


Platforms
Boys down
Hall
Up
Porch
Closet
Wardrobe
Wardrobe
School Room.
50 pupils.
Vent Shaft
Vent guard
Warm air
Girls down
Hall
Up
Porch
W.C.
Closet
Platforms
School Room.
50 pupils.

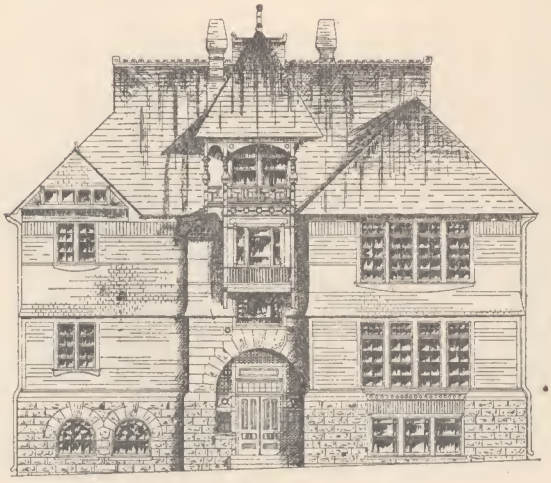
PLAN NO. 8, SECOND FLOOR.



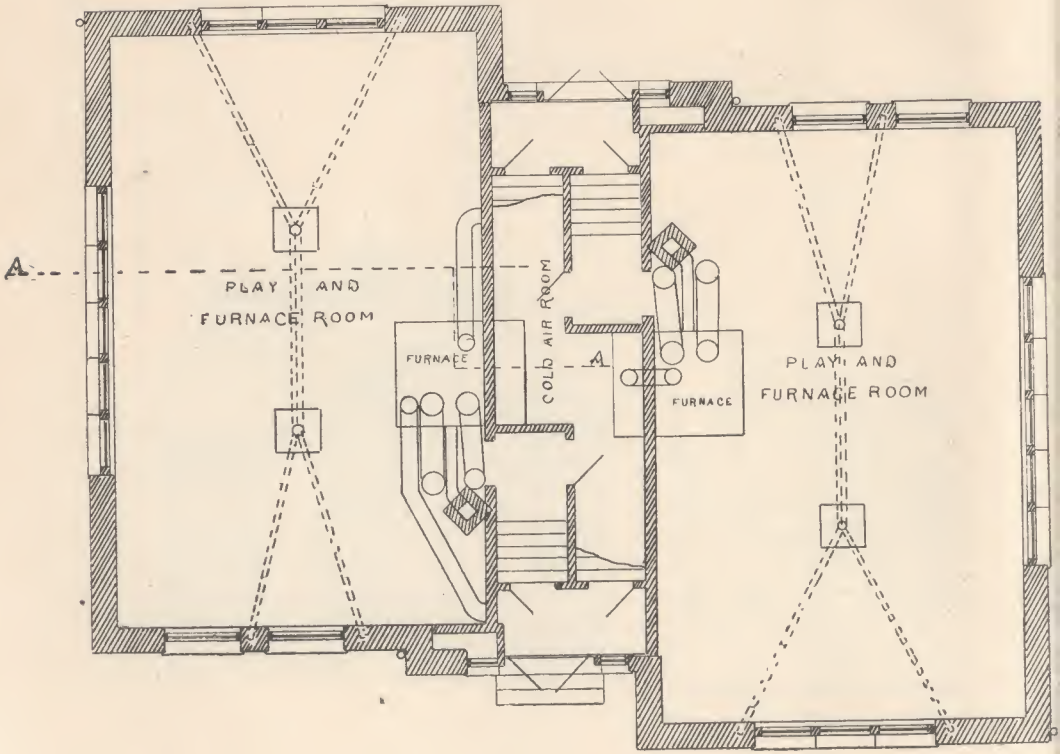
The ninth design gives cuts of a four-room building, erected at Bayfield in 1889. Staircases, wardrobes, corridors, library and office are amply lighted and are easily accessible.



SECTION A A

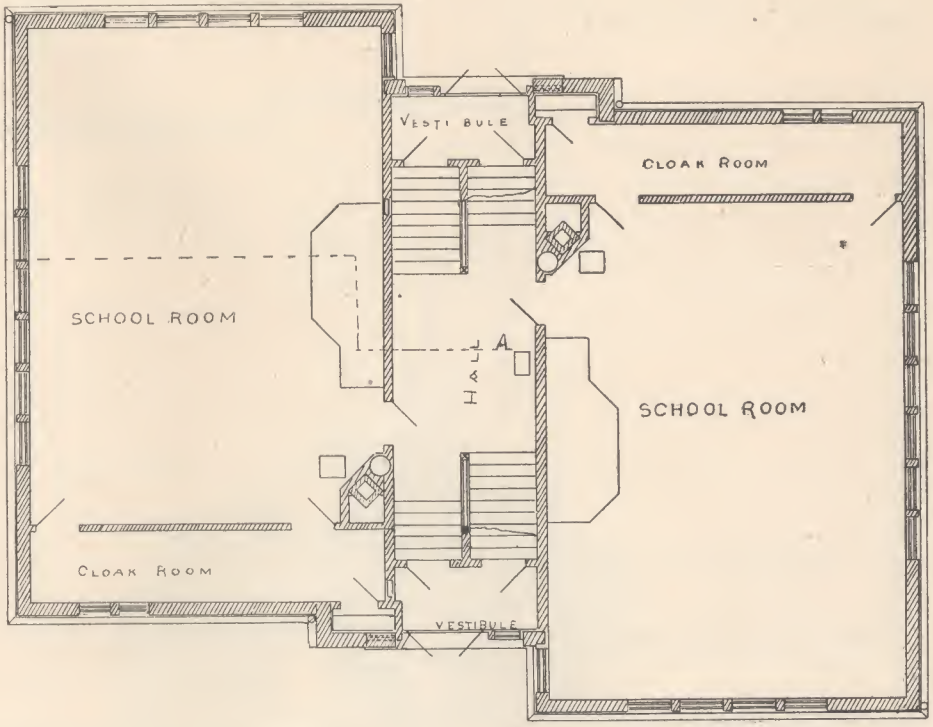


EAST SIDE ELEVATION

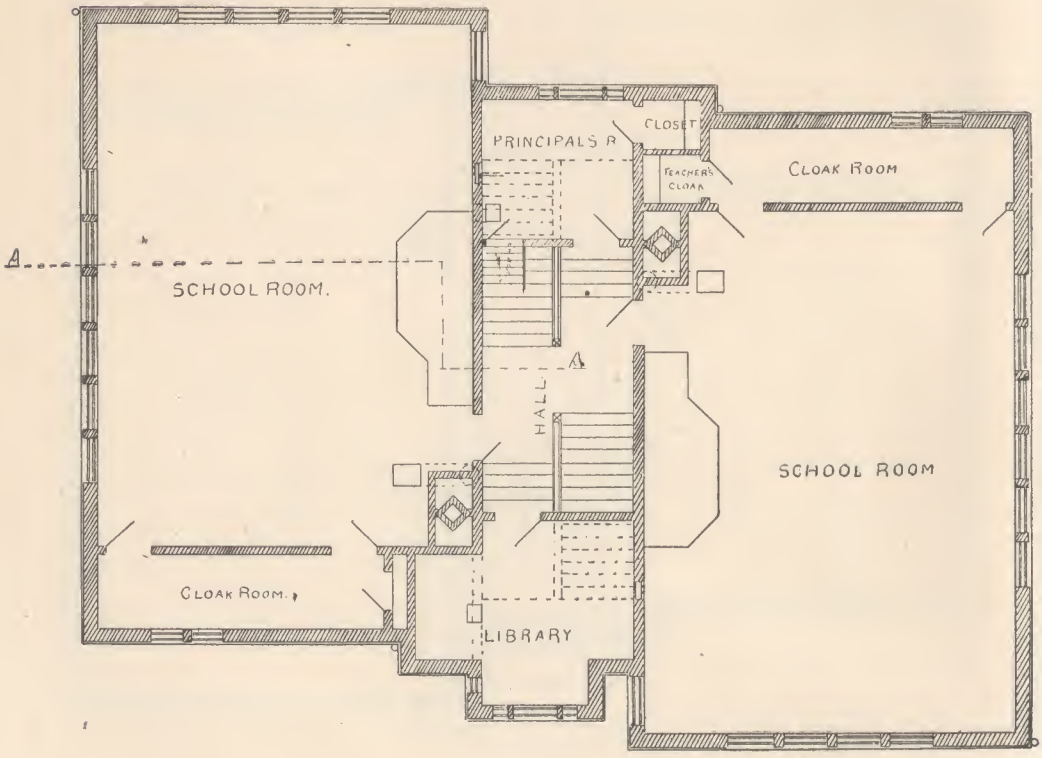


BASEMENT PLAN

4 FEET = 1 INCH



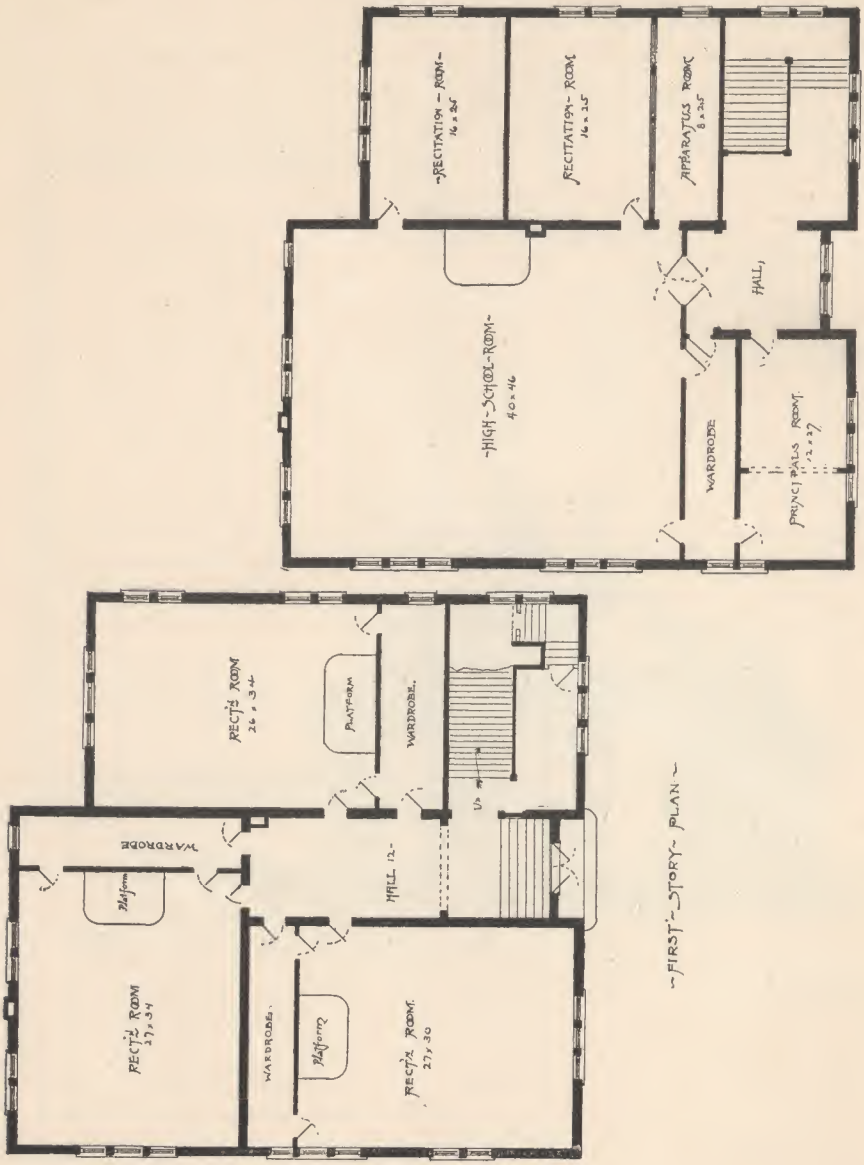
FIRST STORY PLAN
4 FEET = 1 INCH



SECOND STORY PLAN.

4 FEET - 1 INCH

The next plan — the tenth in the series — presents a combination of three rooms on the first floor, and a high school room and two recitation rooms on the second floor. This house is fairly equivalent to a sixroom building, and is provided with such auxiliary rooms as a first-class building of this kind requires.

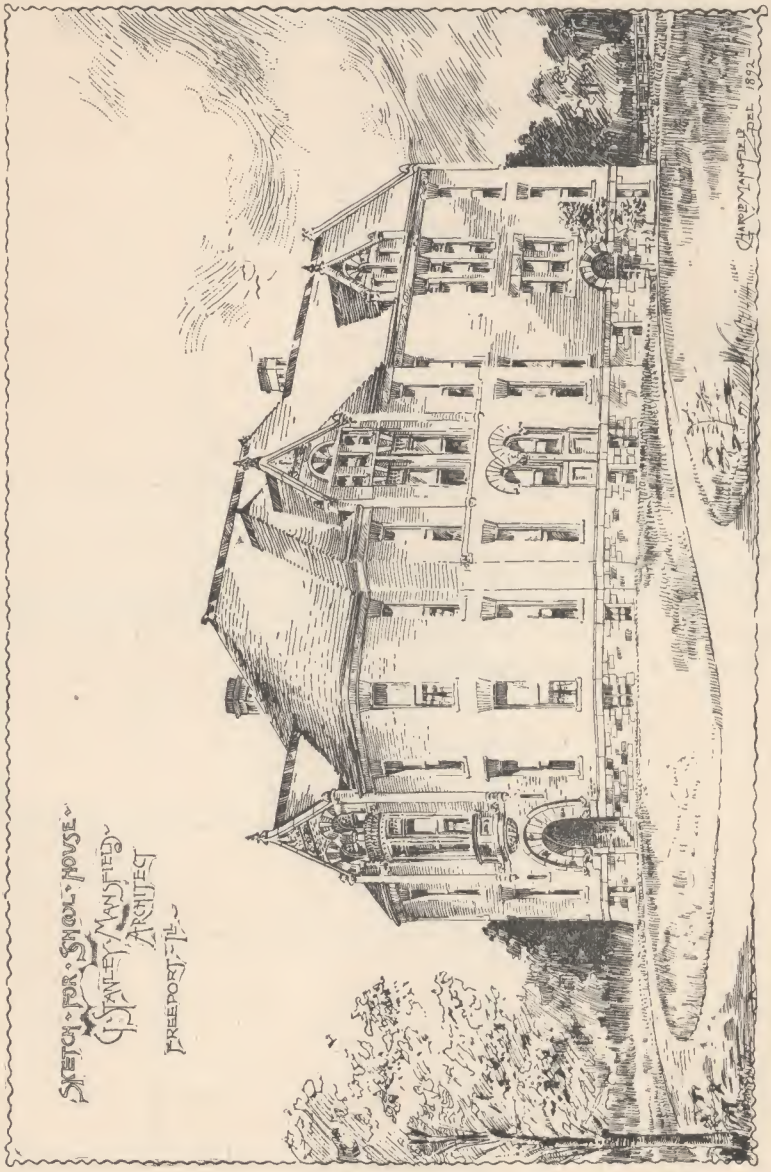


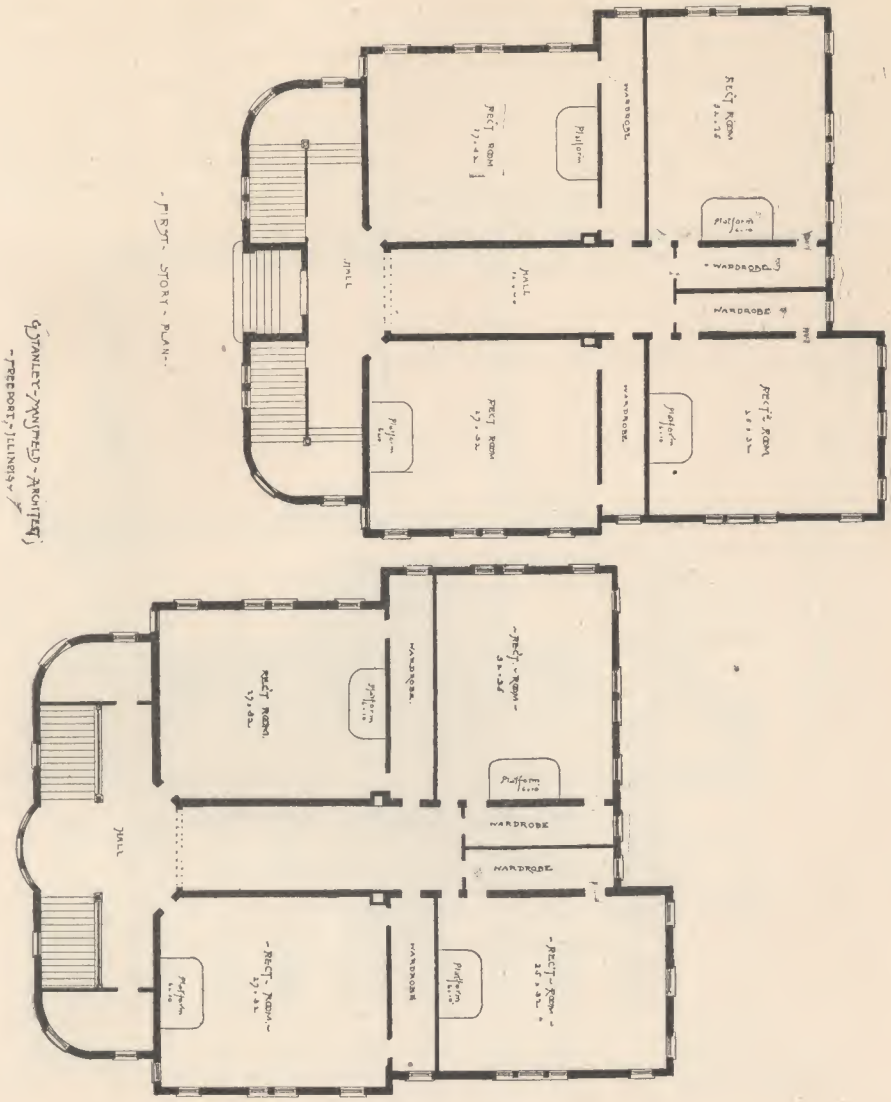
~FIRST~STORY~ PLAN ~

~SECOND~STORY~ PLAN ~

G. STANLLEY ~ MANSFIELD ARCHT
FREEPORT ~ ILLS.

The eleventh design gives a perspective view and floor plans of an eight-room, two-story building. This house has a fine front that is unique in appearance, but the cut fails to convey its real attractiveness. It will be noticed that but one wardrobe is provided for each room. Each of these rooms should be divided by a partition, thus furnishing separate accommodations for the sexes, and additional exits should be provided.


SKETCH FOR SCHOOL HOUSE
J. STANLEY MANSFIELD
ARCHITECT
FREEPORT, ILL.
CHADWICK & DEL 1892

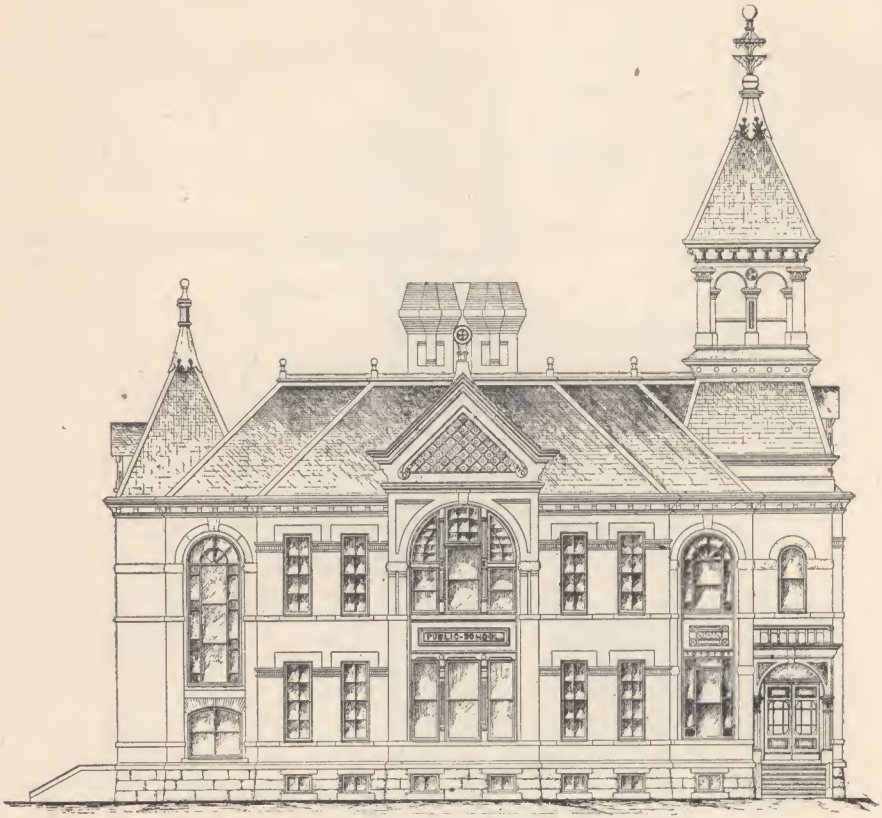


FIRST STORY PLAN

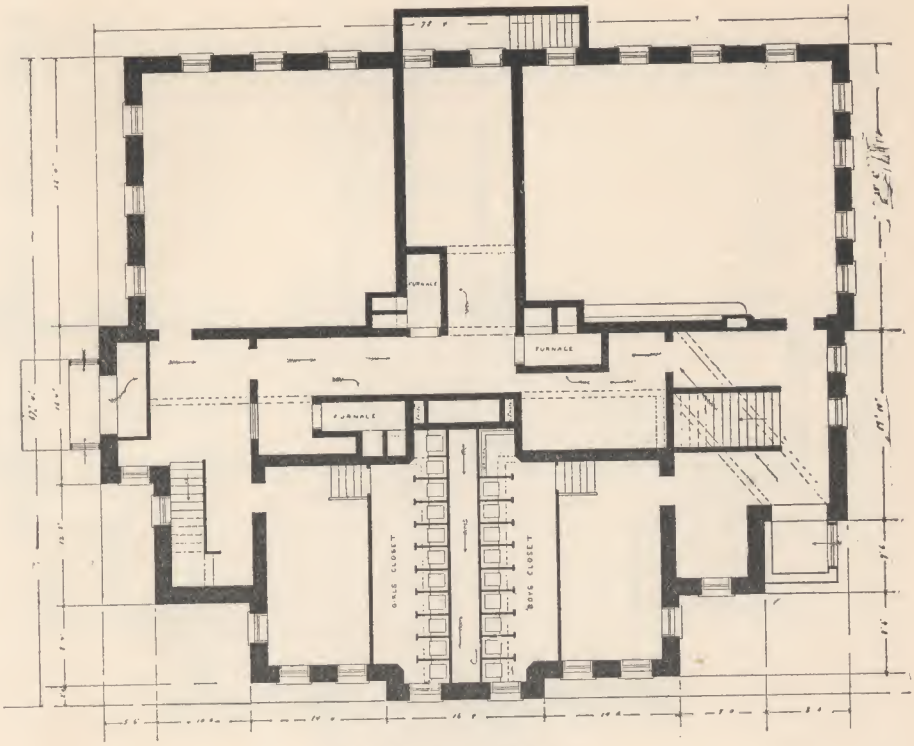
(STANLEY, MANSFIELD, ARCHITECTS)
FREEPORT, ILLINOIS

SECOND STORY PLAN

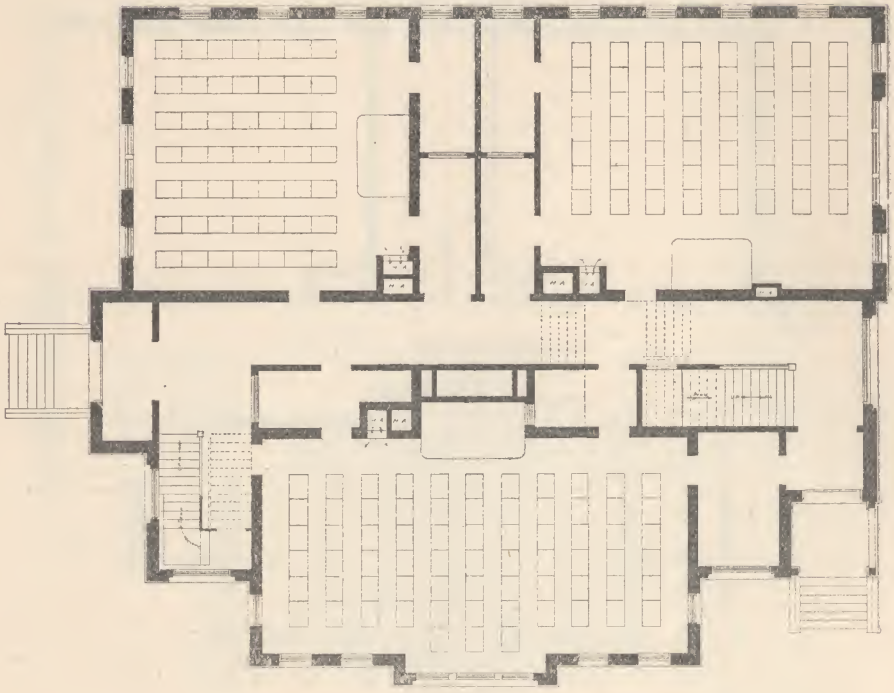
The twelfth diagrams exhibit a house built in 1888 at Prescott, which has given great satisfaction in its accommodations for the several grades of a small town. Attention may be directed especially to the entrances of this house, and to its fine architectural appearance. Some places will prefer a larger room for the high school and also a larger room for the use of the assistant, both of which ends may be attained without enlarging the main structure by employing a different distribution of the second floor space.



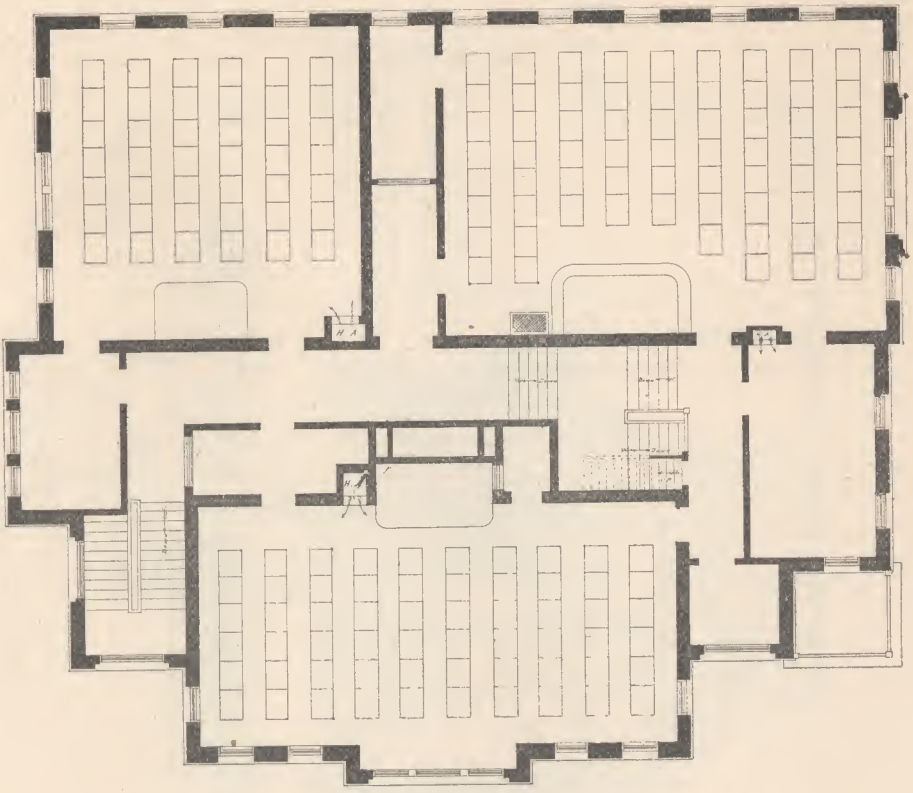
FRONT ELEVATION.



BASEMENT PLAN.



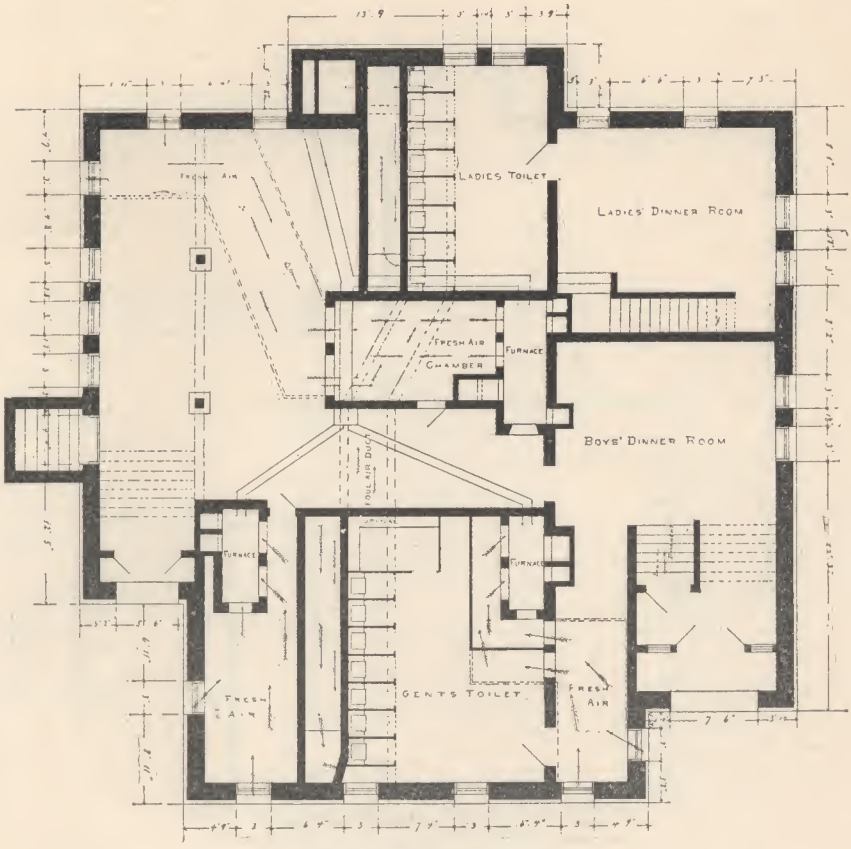
FIRST FLOOR PLAN.



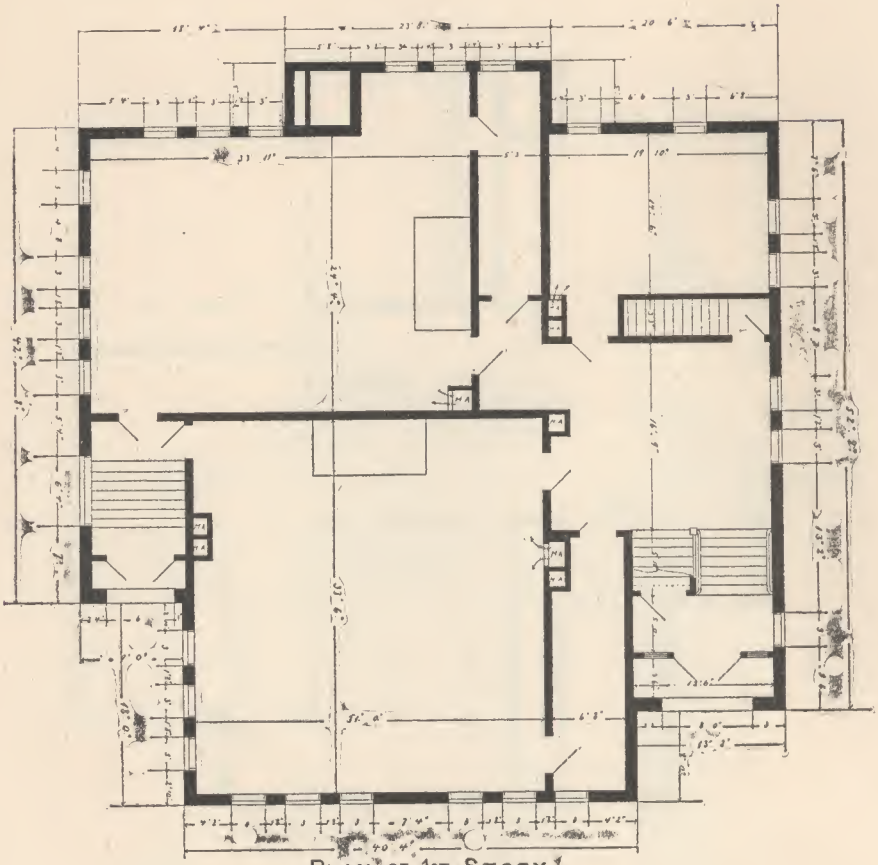
SECOND FLOOR PLAN.

The thirteenth design was prepared for an eight-room building for high school and grammar grades, at Columbus, Wis. The diagrams show front elevation, basement and floor plans of a convenient and attractive school house.

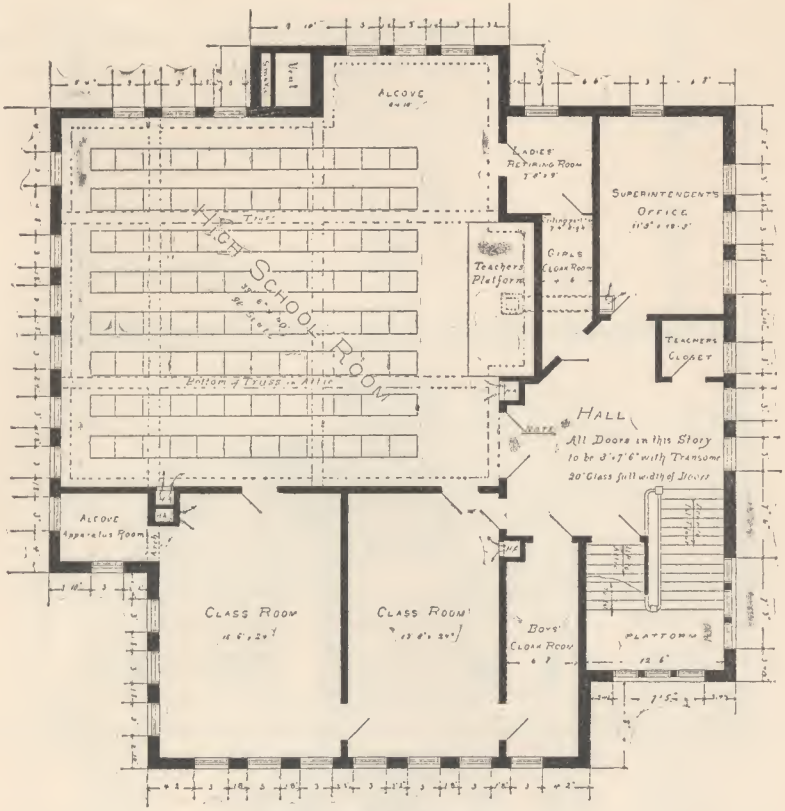
FRONT ELEVATION.



PLAN OF BASEMENT.

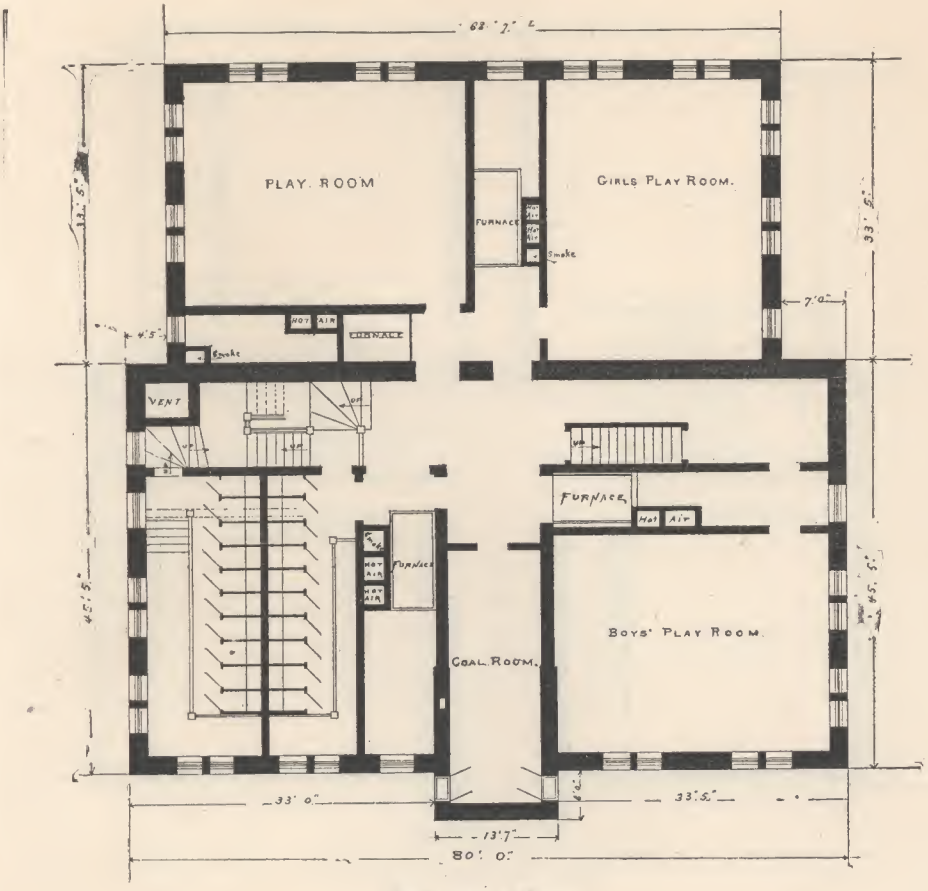


PLAN OF 1ST STORY.

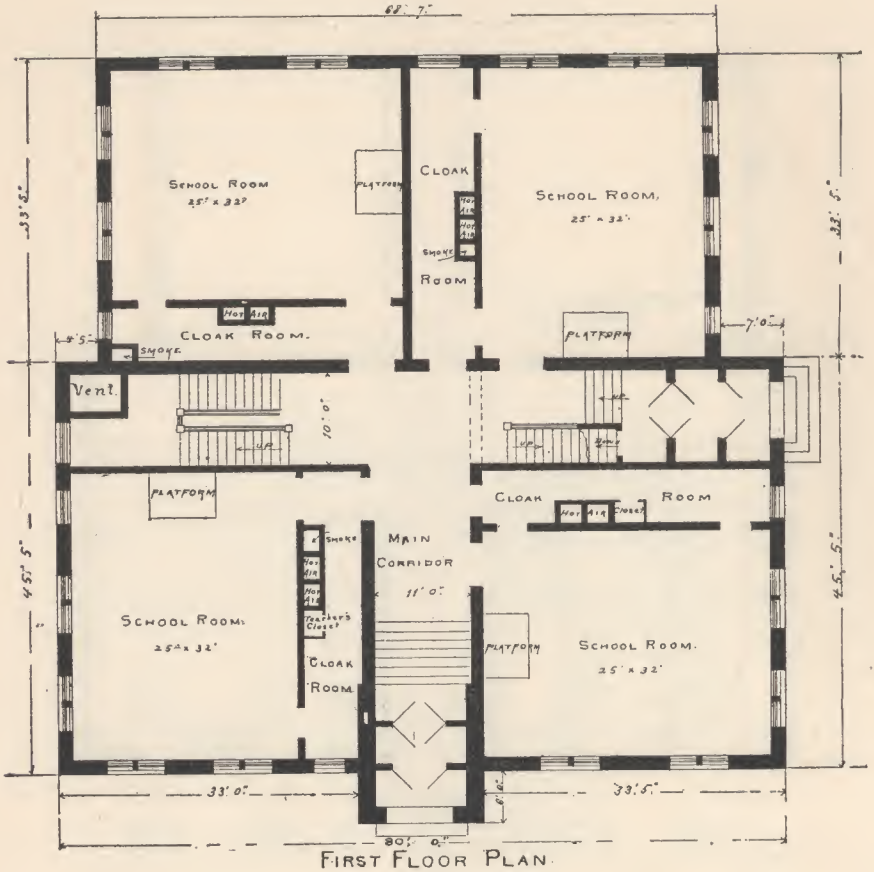


PLAN OF 2ND STORY.

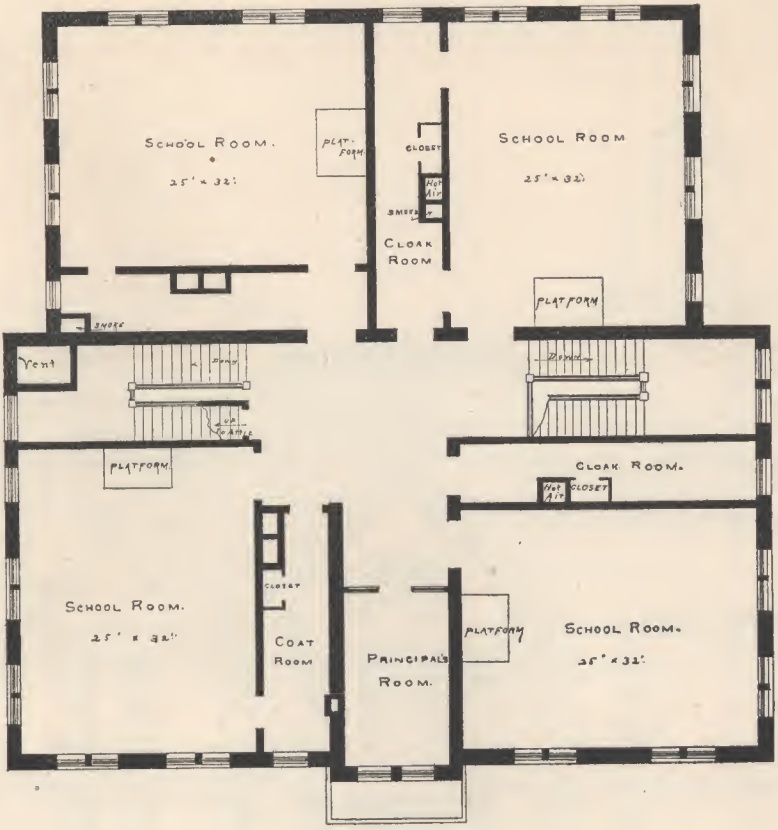
The fourteenth design has been used as a model for construction in a neighboring state. It presents an eight room house, especially designed as a ward building and for grades below the high school. It may be used for high school and grammar grades by giving one room on the second floor to first year high school pupils, another to second year pupils, and assigning third and fourth year pupils to another. The remaining room on this floor would be available for apparatus and as a recitation room. Such a plan has been adopted in many places, and has much to commend it.



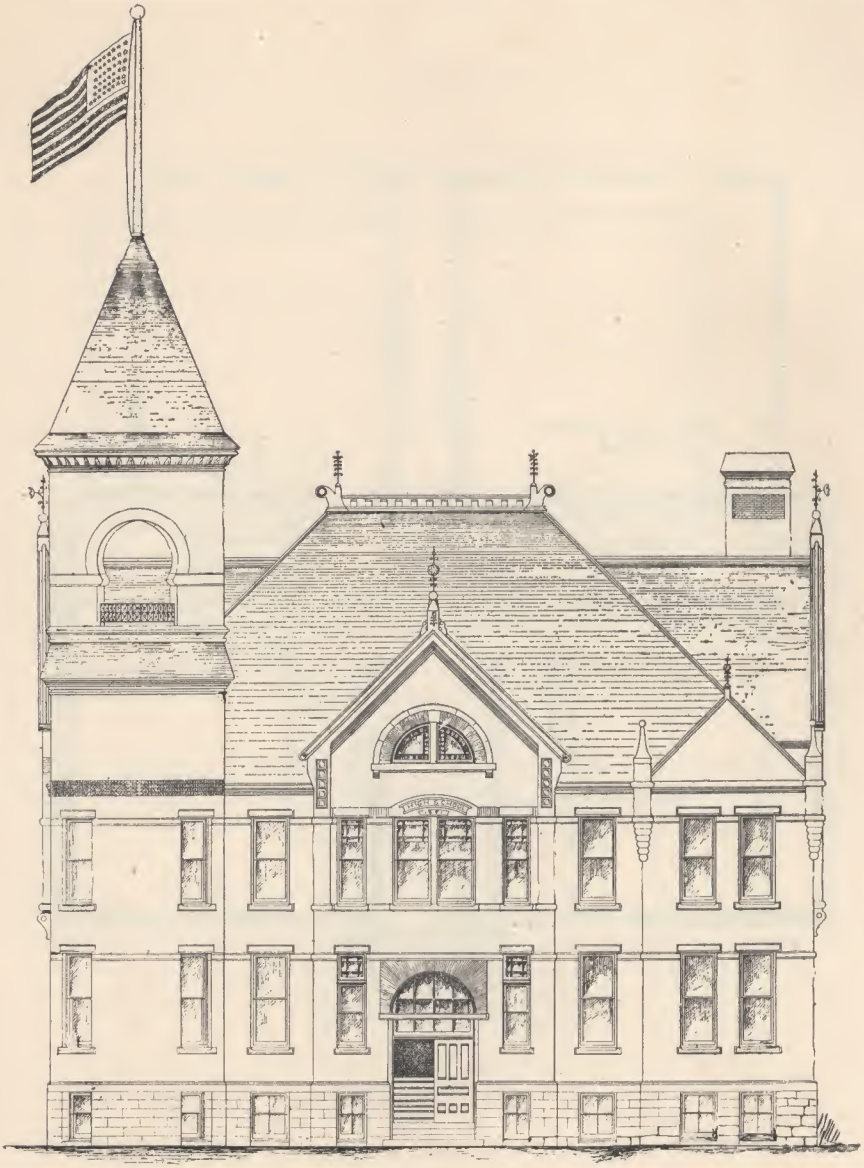
BASEMENT PLAN.



FIRST FLOOR PLAN.

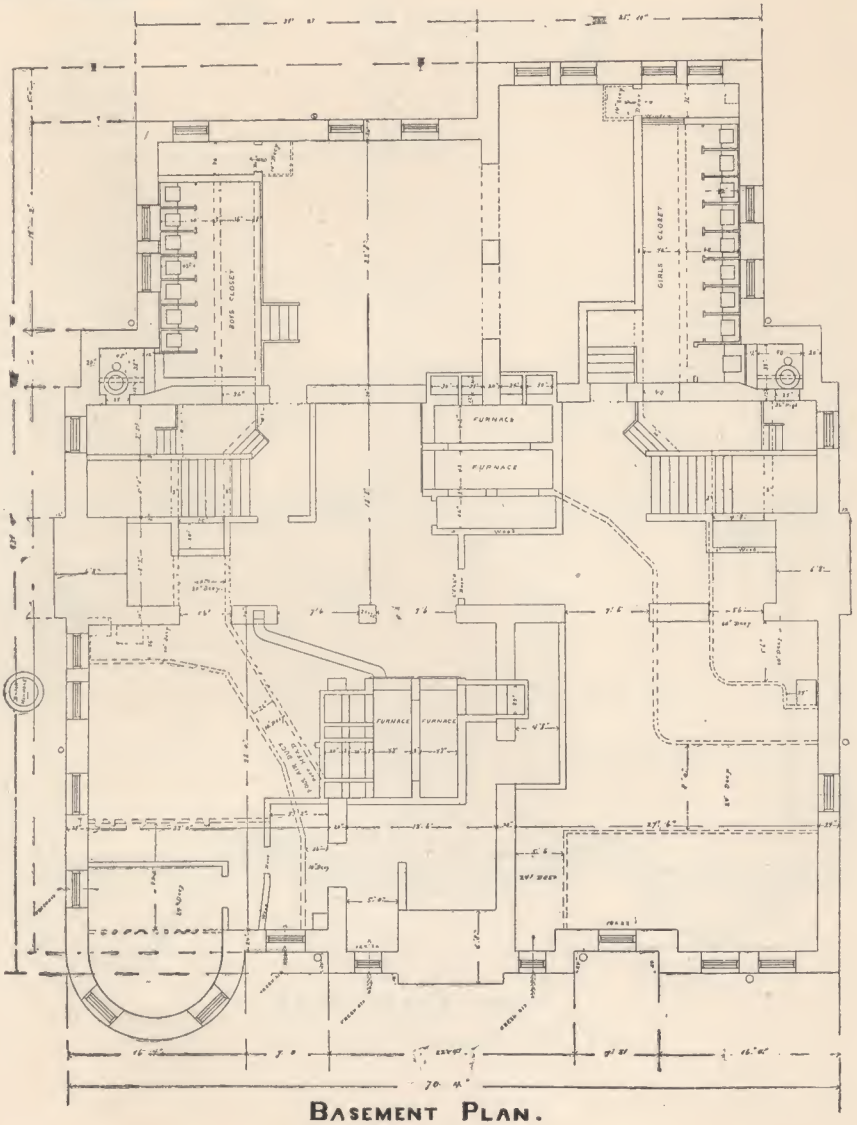


SECOND FLOOR PLAN.

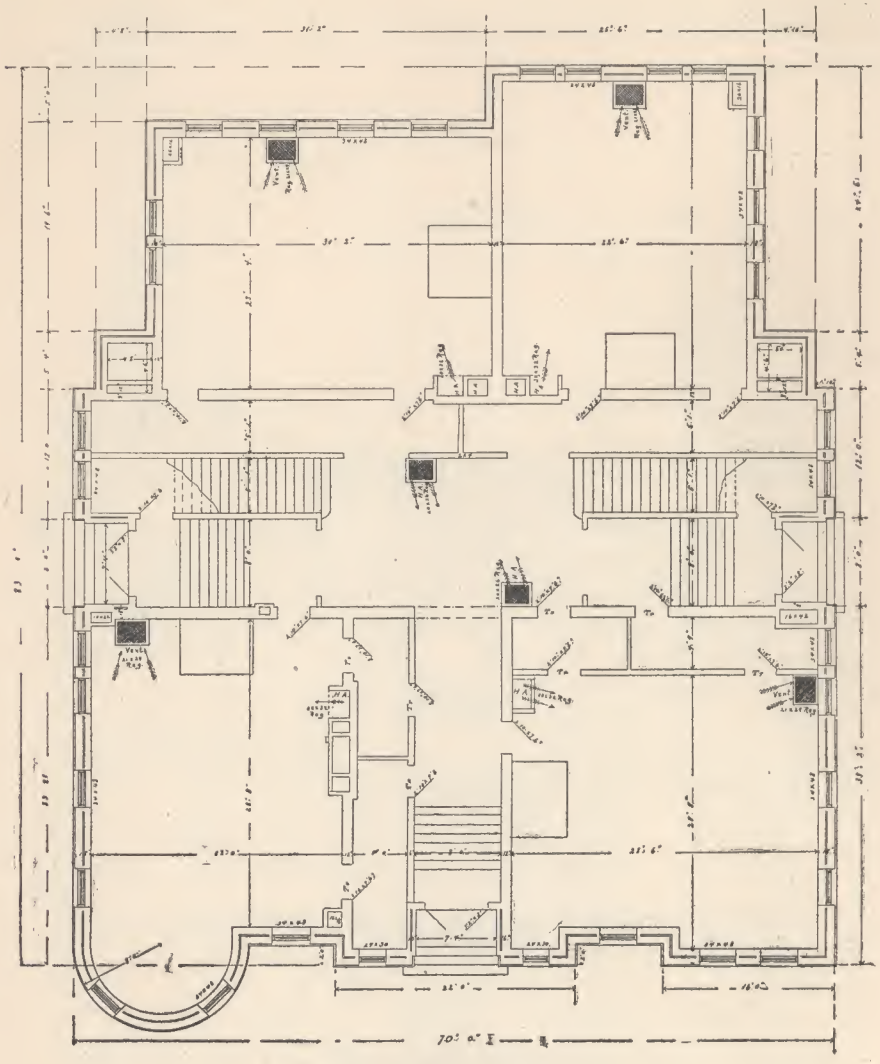


FRONT ELEVATION

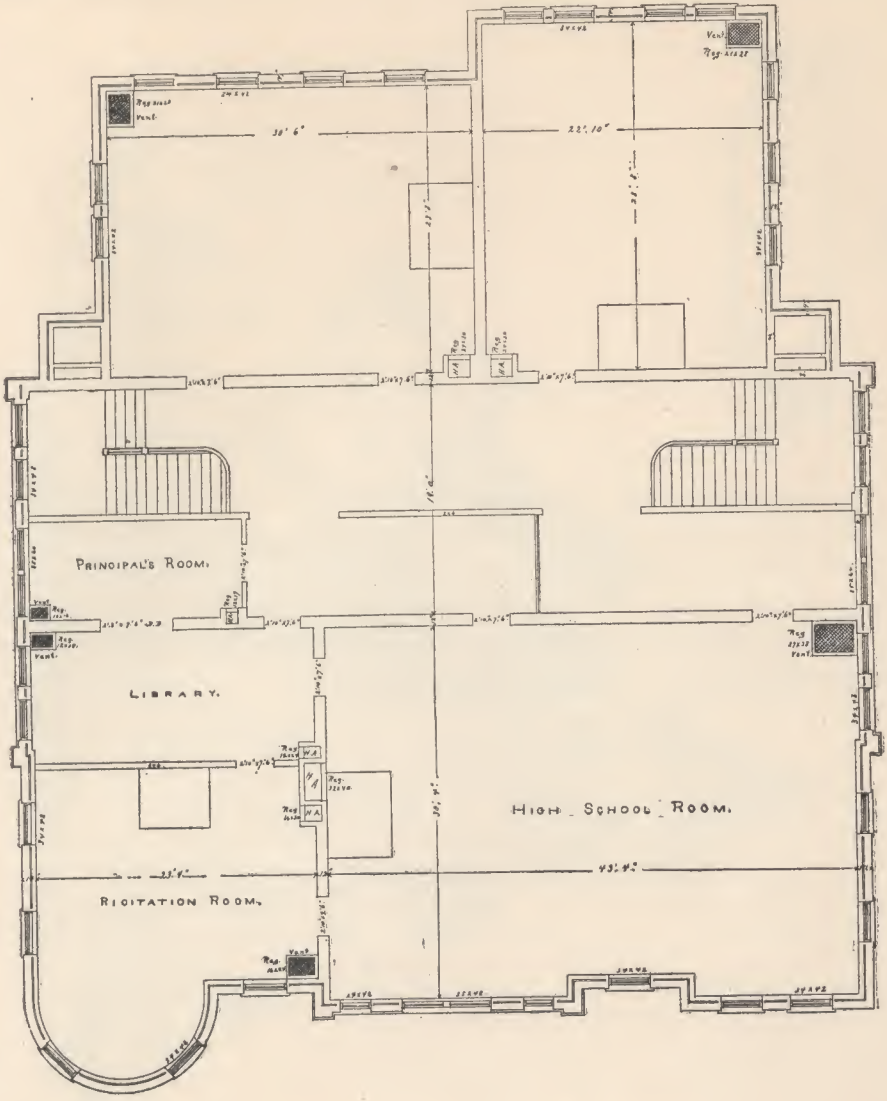
The fifteenth house presented in this circular was built at Antigo, in 1891. It is a beautiful structure, and, it is understood, has proven satisfactory in all essential particulars.



BASEMENT PLAN.

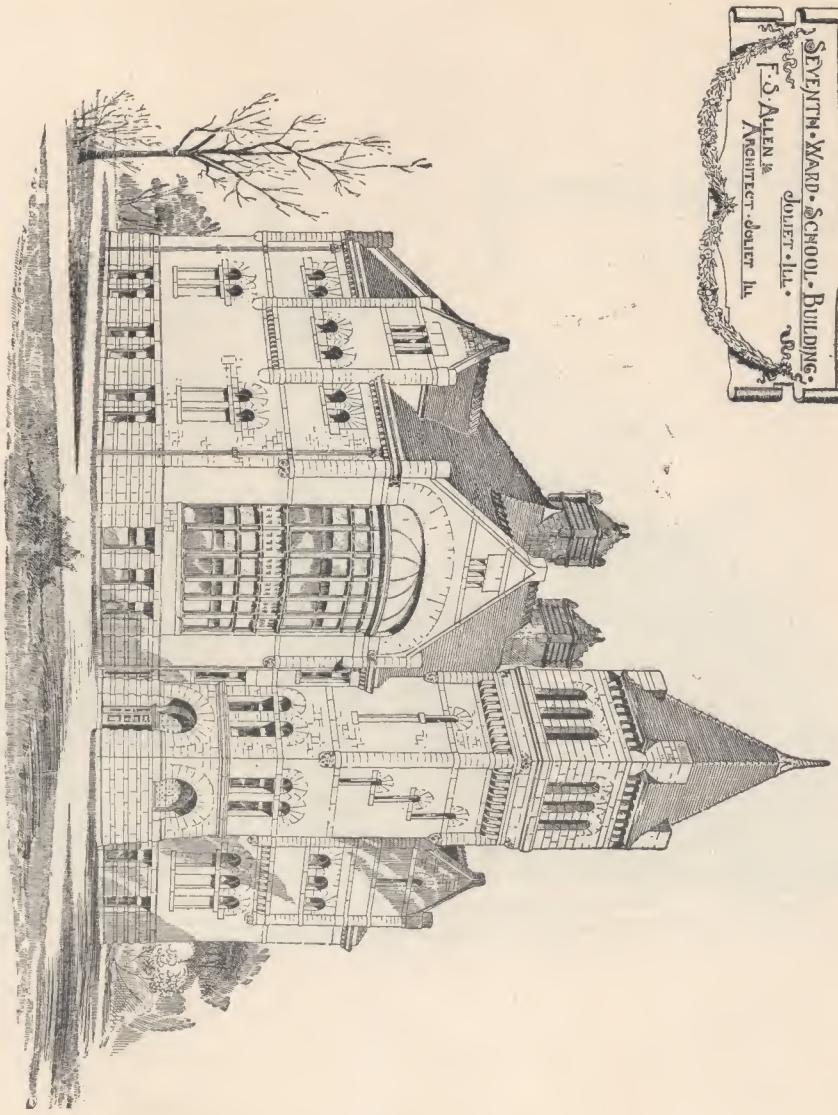


FIRST FLOOR PLAN.

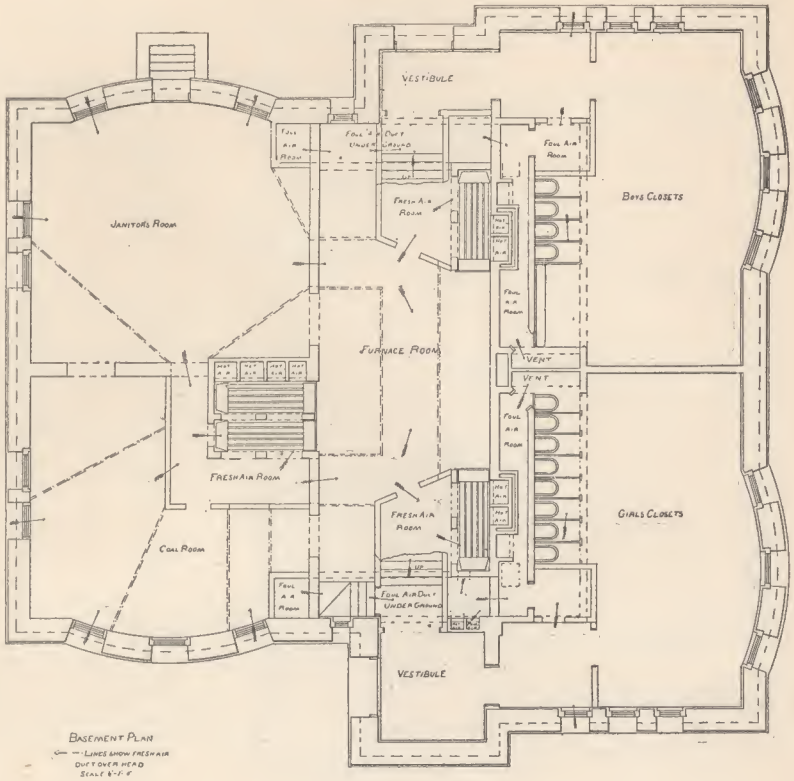


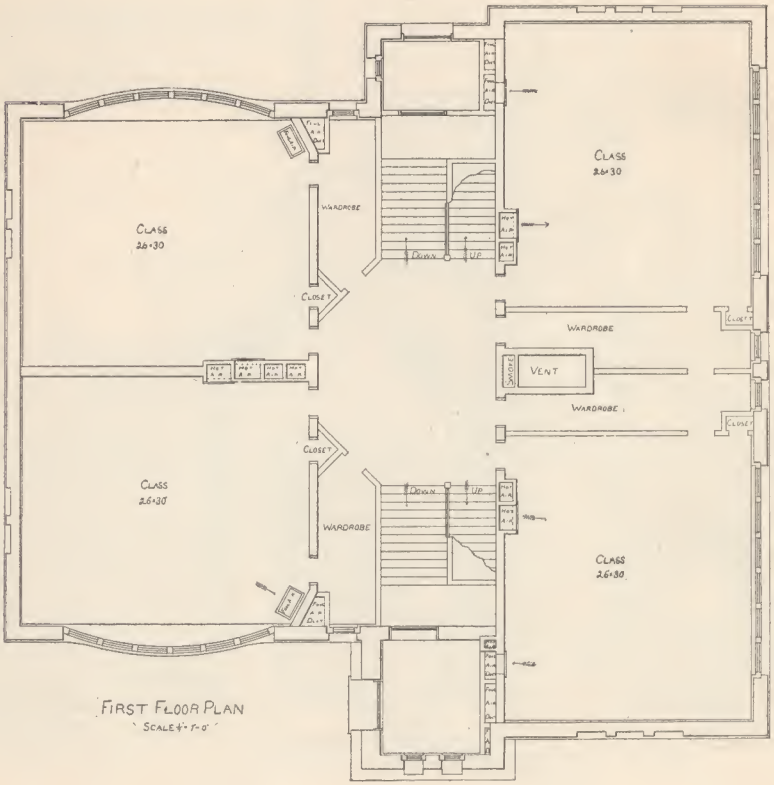
SECOND FLOOR PLAN.

The sixteenth design varies from the fourteenth in no essentials, but presents the distribution of rooms in a little different way. The accessibility by stairs, the corridors, and the architectural effect through the swell fronts are presented in a striking way, as may be seen from the plans of the basement, the floors and the elevations. The elevations are of different buildings, but the internal arrangements are adapted to either exterior.

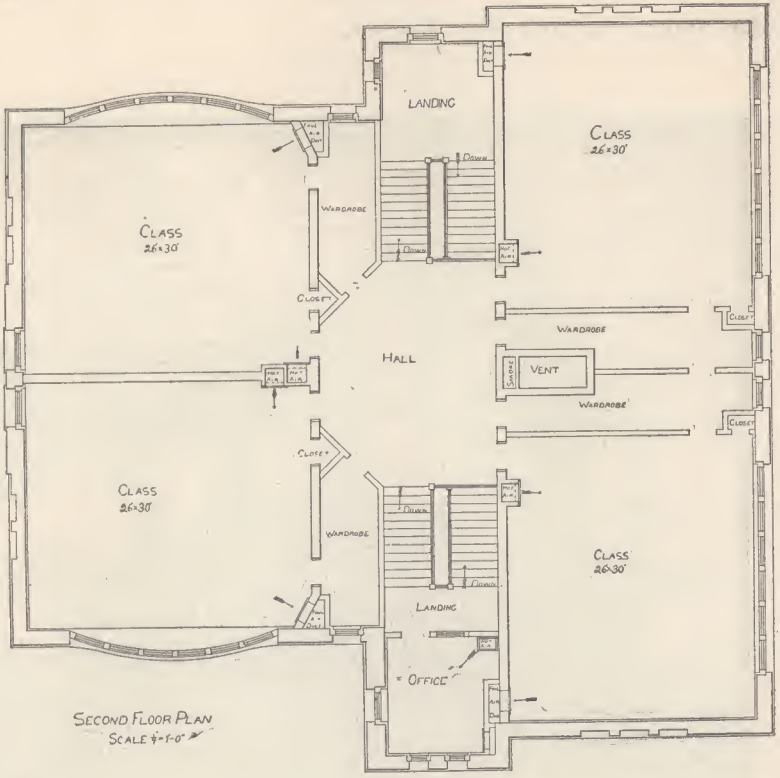

SEVENTH WARD SCHOOL BUILDING.
JOLIET ILL.
F. S. ALLEN
ARCHITECT JOLIET ILL


FIFTH·WARD·SCHOOL·BUILDING·
JOLIET · ILL
F. S. ALLEN
ARCHITECT · JOLIET · ILL.


VESTIBULE
FOUL AIR ROOM
FOUL AIR OUT UNDER GROUND
FRESH AIR ROOM
JANITOR'S ROOM
FURNACE ROOM
FRESH AIR ROOM
COAL ROOM
FOUL AIR ROOM
FRESH AIR ROOM
FOUL AIR DUCT UNDER GROUND
VESTIBULE
FOUL AIR ROOM
BOYS CLOSETS
FOUL AIR ROOM
VENT
VENT
FOUL AIR ROOM
GIRLS CLOSETS
BASEMENT PLAN
— — LINES SHOW FRESH AIR DUCT OVER HEAD
SCALE 8-F-6

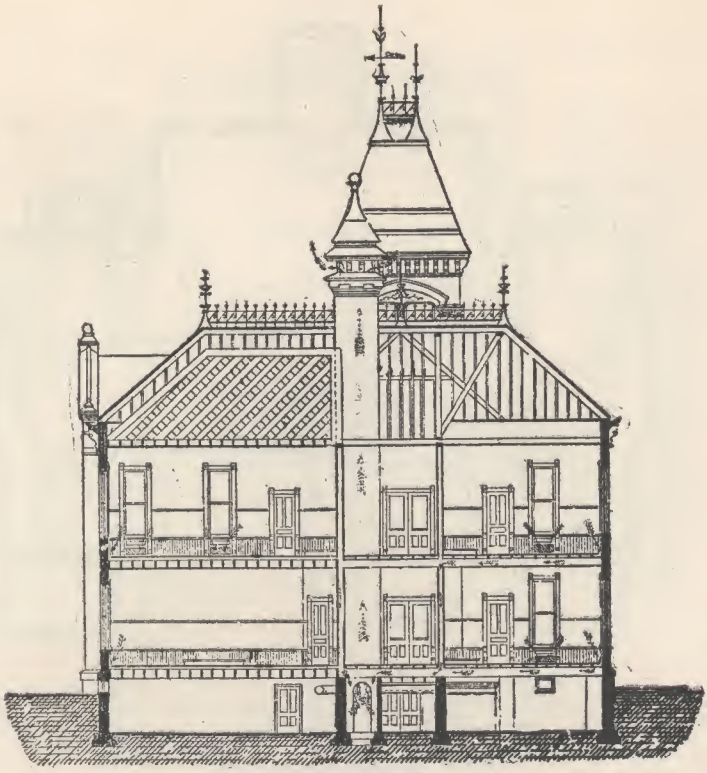


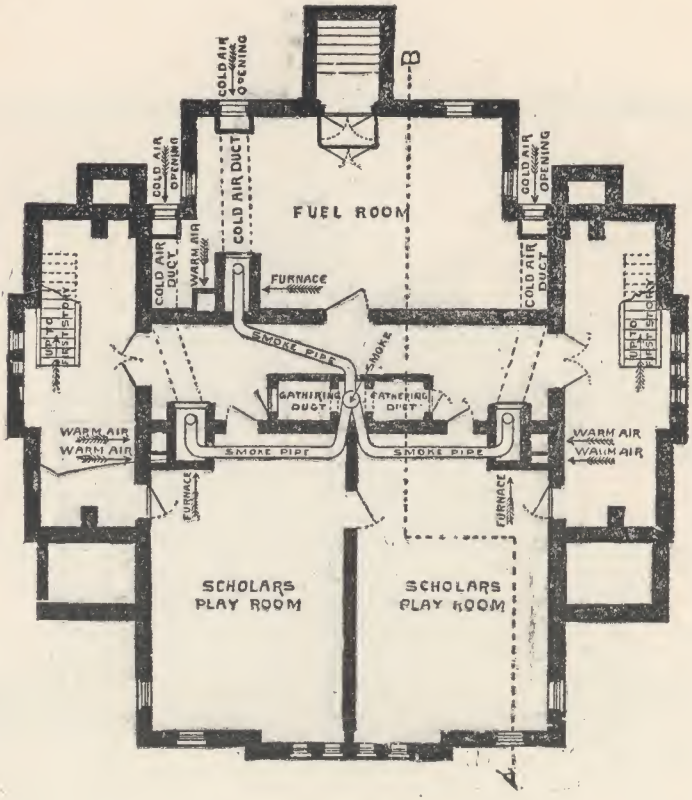
FIRST FLOOR PLAN
SCALE ¼" = 1'-0"

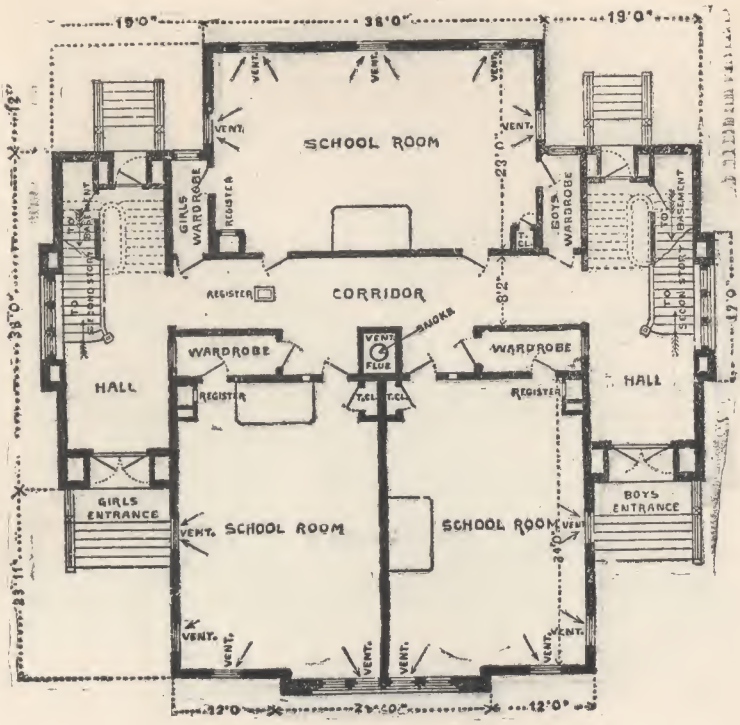


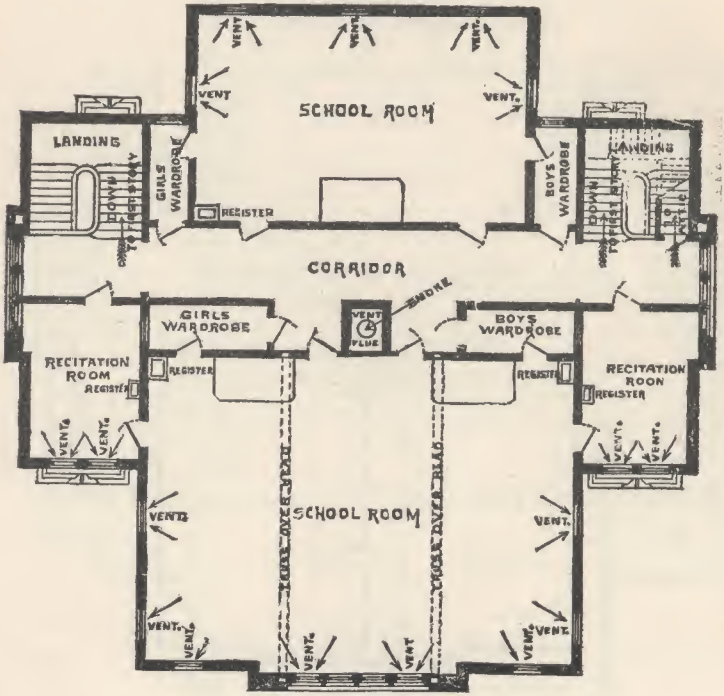
SECOND FLOOR PLAN
SCALE ¼-1-0"

The seventeenth design presents a perspective view, a longitudinal section, basement, and first and second floor plans of a five room building, erected at River Falls in 1880, at a cost of $12,000. The plans were prepared by Messrs. Edbrooke and Burnham of Chicago, and were embraced in the circular of Supt. Whitford. It is a beautiful structure, and experience has demonstrated its adaptation to the needs of village schools.

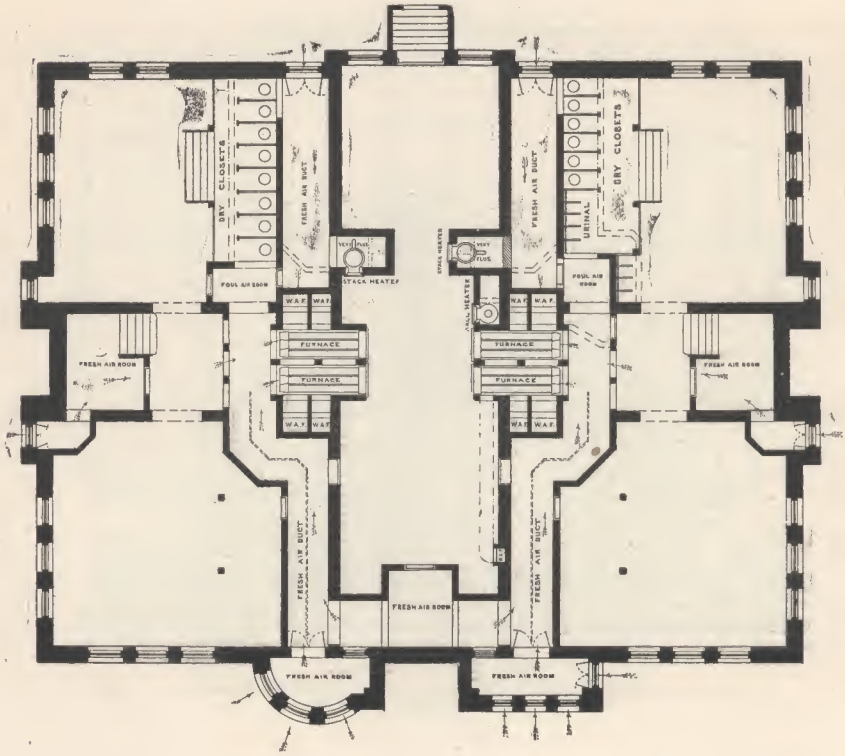


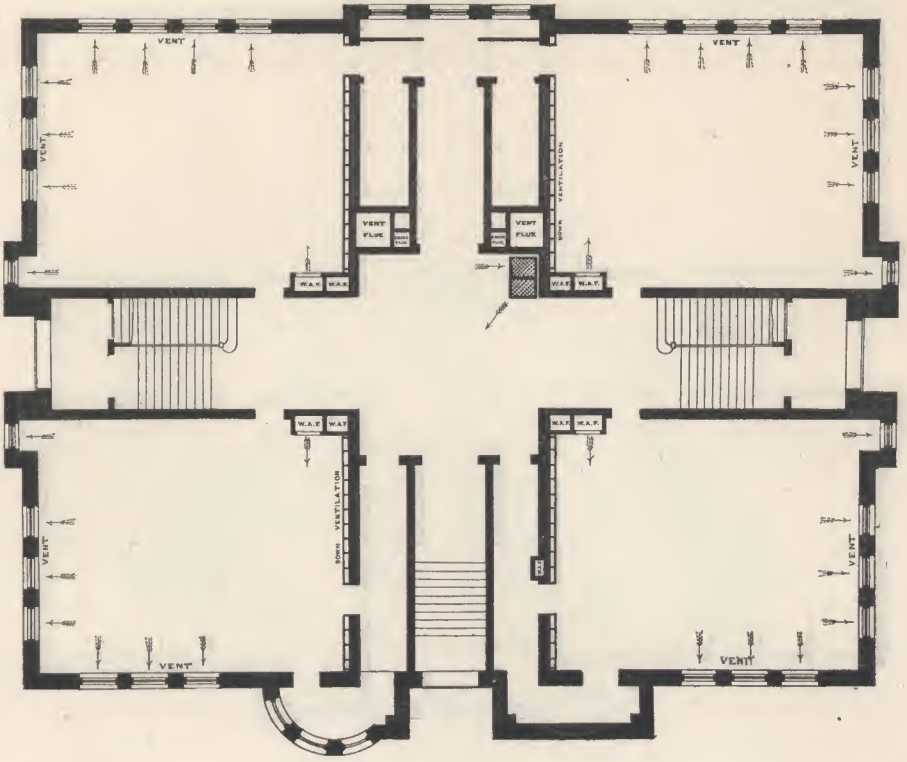

COLD AIR OPENING
B
COLD AIR OPENING
COLD AIR DUCT
COLD AIR OPENING
FUEL ROOM
COLD AIR DUCT
WARM AIR
FURNACE
COLD AIR DUCT
UP TO FIRST STORY
SMOKE PIPE
SMOKE
UP TO FIRST STORY
GATHERING DUCT
GATHERING DUCT
WARM AIR
WARM AIR
SMOKE PIPE
SMOKE PIPE
WARM AIR
WARM AIR
FURNACE
FURNACE
SCHOLARS PLAY ROOM
SCHOLARS PLAY ROOM

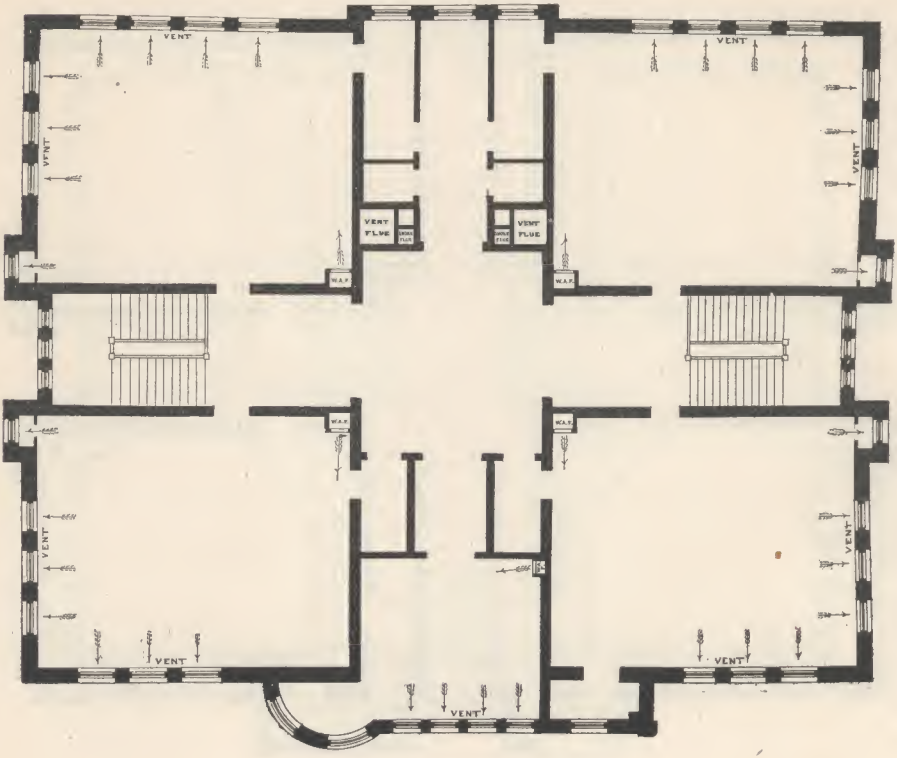

19'0"
38'0"
19'0"
SCHOOL ROOM
VENT.
GIRLS WARDROBE
REGISTER
BOYS WARDROBE
23'0"
CORRIDOR
8'2"
SMOKE
VENT FLUE
WARDROBE
WARDROBE
HALL
HALL
REGISTER
REGISTER
GIRLS ENTRANCE
BOYS ENTRANCE
SCHOOL ROOM
SCHOOL ROOM
12'0"
21'0"
12'0"


SCHOOL ROOM
LANDING
GIRLS WARDROBE
REGISTER
BOYS WARDROBE
LANDING
CORRIDOR
GIRLS WARDROBE
VENT FLUE
SMOKE
BOYS WARDROBE
RECITATION ROOM
REGISTER
REGISTER
REGISTER
RECITATION ROOM
REGISTER
SCHOOL ROOM
VENT

Perspective View
West Superior School

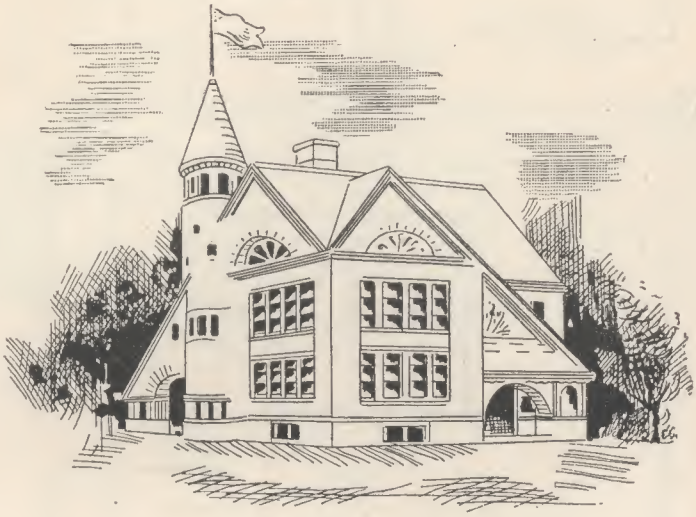

DRY CLOSETS
FRESH AIR DUCT
VESTIBULE
STACK HEATER
FOUL AIR ROOM
W.F.
W.F.
FURNACE
FURNACE
W.F.
W.F.
FRESH AIR ROOM
FRESH AIR DUCT
FRESH AIR ROOM
FRESH AIR ROOM
STACK HEATER
VENT FLUE
FRESH AIR DUCT
URINAL
DRY CLOSETS
FOUL AIR ROOM
W.F.
W.F.
FURNACE
FURNACE
W.F.
W.F.
FRESH AIR ROOM
FRESH AIR DUCT
FRESH AIR ROOM
FRESH AIR ROOM


VENT
VENT
VENT
VENT
VENT FLUE
VENT FLUE
W.A.F
W.A.F
W.A.F
W.A.F
W.A.F
W.A.F
W.A.F
W.A.F
VENTILATION
VENTILATION
VENT
VENT
VENT
VENT
VENT

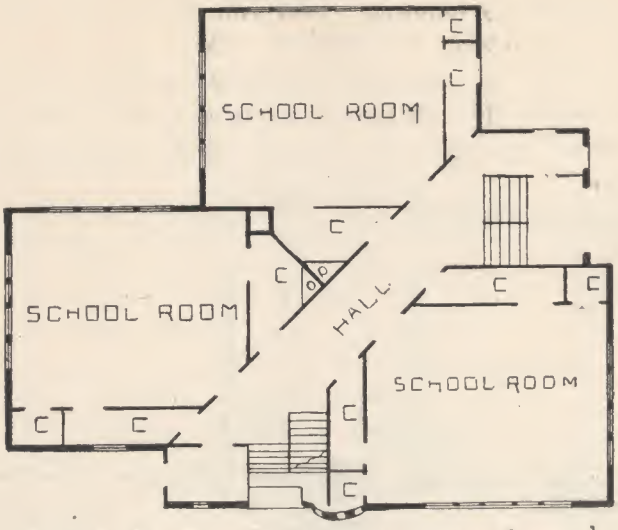

VENT
VENT
VENT
VENT
VENT FLUE
VENT FLUE
W.P.
W.P.
W.P.
W.P.
VENT
VENT
VENT
VENT
VENT
VENT

The cuts immediately following (Plan No. 19) are from the portfolio of Elah Terrell & Co., Architects, of Columbus, Ohio.

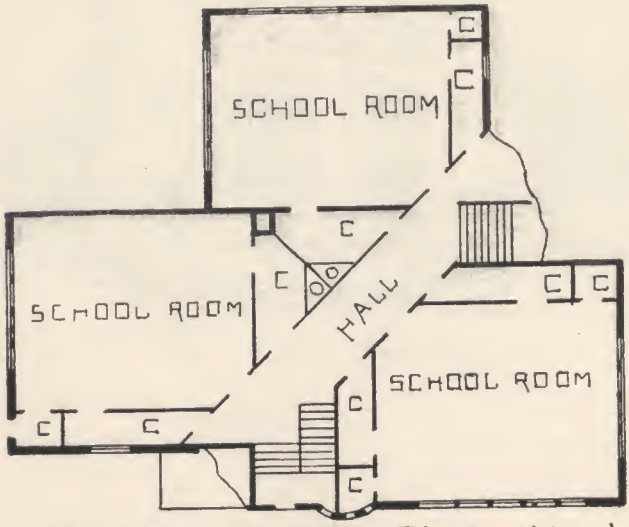
They may be used for one or for two story buildings, and in either form, may be extended indefinitely. By the use of these plans growing villages may increase their school room accommodations without marring the harmony of the original design.



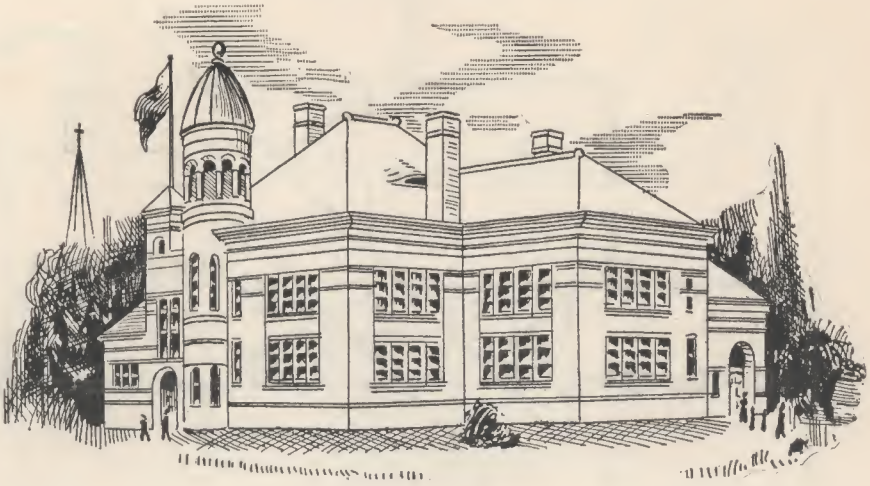
VIEW. No 1



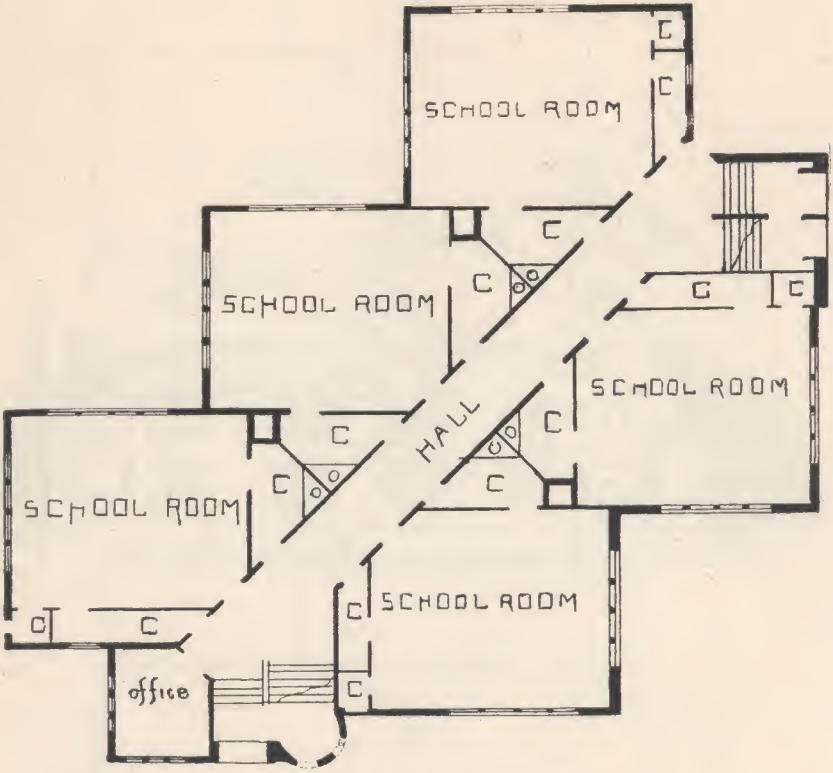
FIRST FLOOR PLAN. No 1



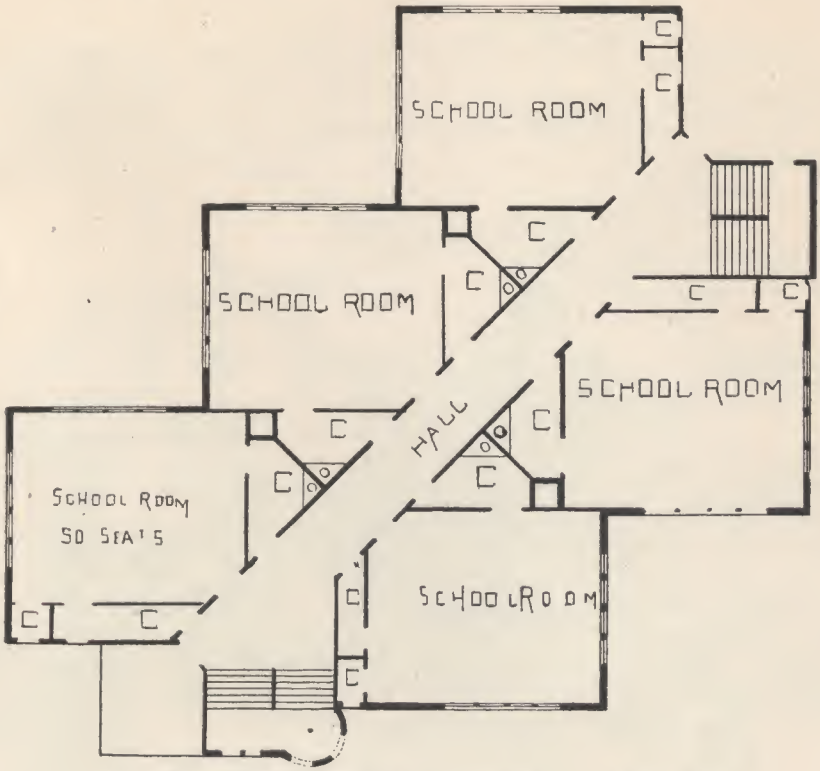
SECOND FLOOR PLAN. No. 1



VIEW. No. 2



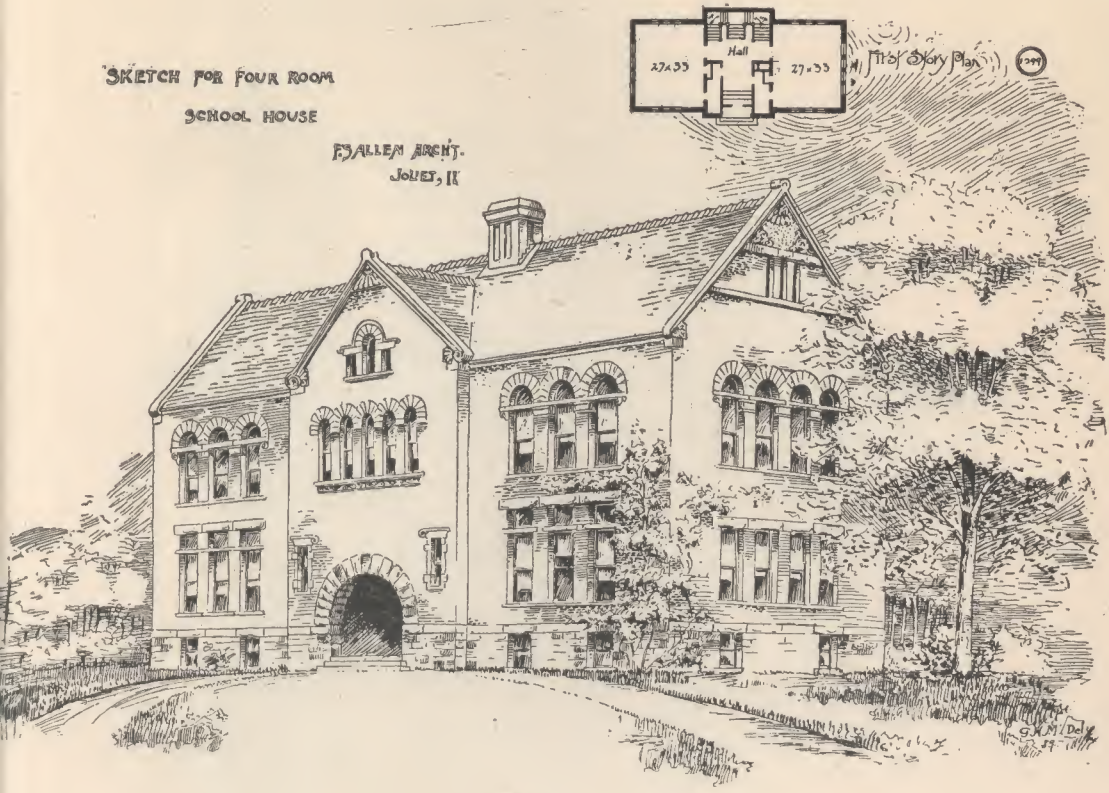
FIRST FLOOR PLAN, No. 2

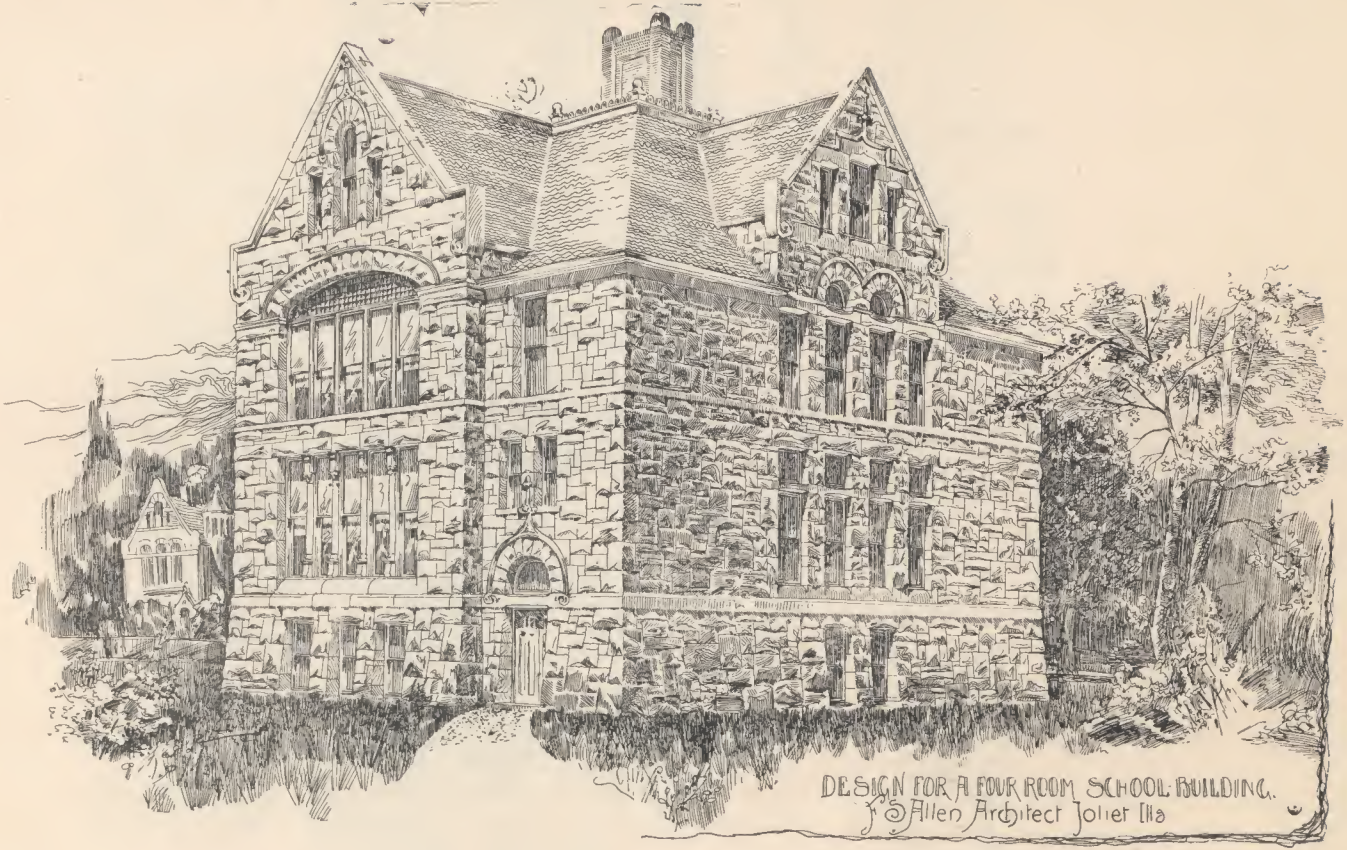


SECOND FLOOR PLAN. No. 2

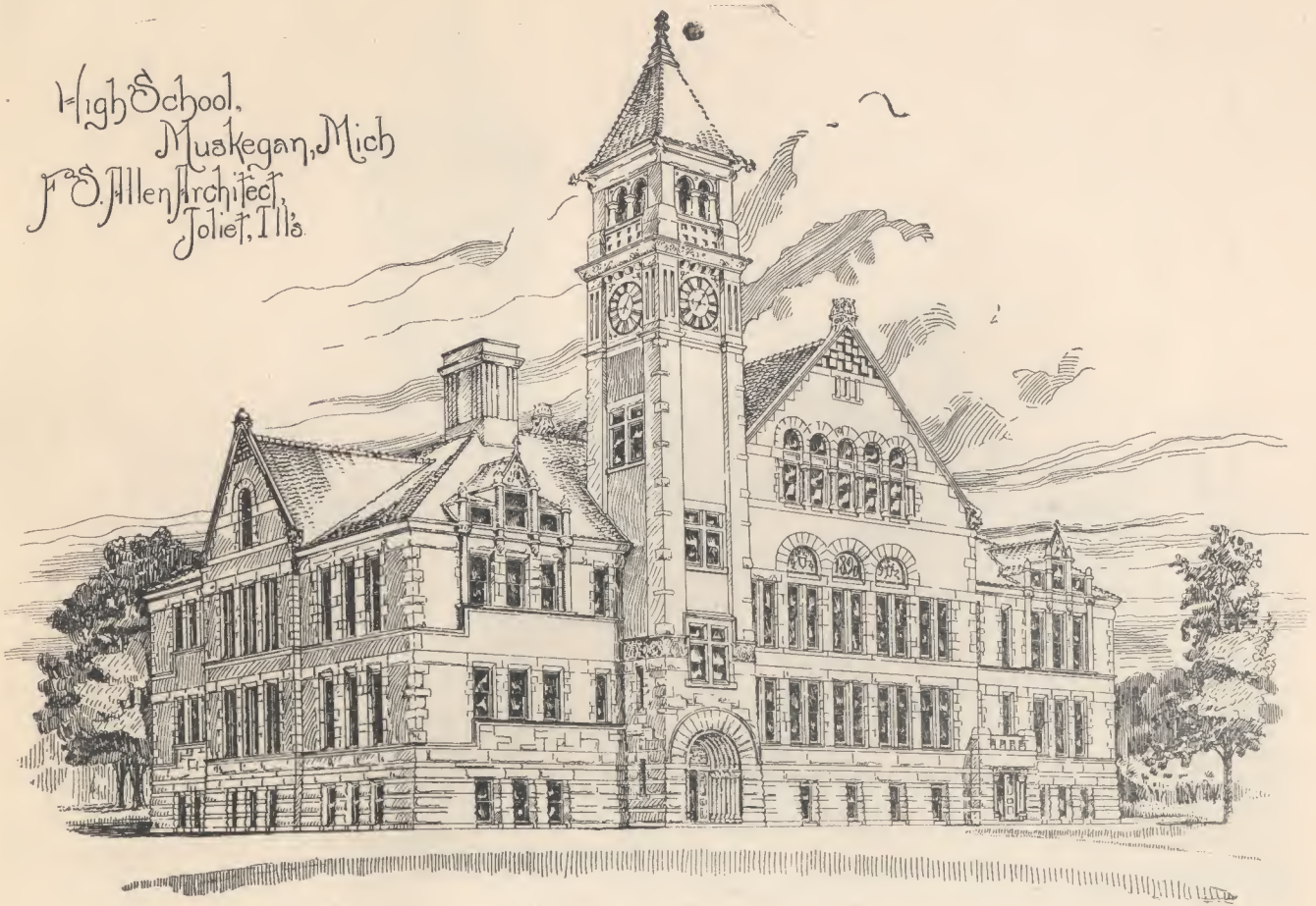
Elevations.

The following elevations are introduced with a view of suggesting to local boards the present state of school architecture, enabling them to select forms that shall at once appeal to the good judgment of citizens in the stable character of the structure, as well as in the aesthetic features of the architectural forms.


SKETCH FOR FOUR ROOM
SCHOOL HOUSE
F.J.ALLEN ARCH'T.
JOLIET, ILL
Hall
27x33
27x33
1st Story Plan
209



DESIGN FOR A FOUR ROOM SCHOOL BUILDING.
J. Allen Architect Joliet Ills


High School,
Muskegan, Mich
F. S. Allen Architect,
Joliet, Ill's.


HIGH SCHOOL
F. O. ALLEN
ARCHITECT
JOLIET, ILL

The cuts on the following pages are presented through the courtesy of The Smead Warming and Ventilating Company. They illustrate a warming, ventilating and dry closet system which may be seen in practical operation in any of the state normal school buildings and in many other public buildings in the state.

This system takes a large volume of fresh air from the outside of the building, conducts it to the large airwarmers or furnaces, which are placed in the basement, where it is warmed (not superheated) and ascends through each school-room through a large flue built of brick. The volume of air thus supplied to each room is sufficient to afford each pupil 1,800 cubic feet per hour, which thus secures adequate ventilation.

The warm-air register is placed seven feet above the floor in order to deliver the air above the heads of the pupils, and to avoid draughts.

By the use of the valves, which are connected with a regulator in each room, the warm air can be shut off and cold air admitted through the same register; or the warm and cold air can be mixed, giving the air in the room any temperature desired. This is what is called "continuous ventilation," because by the use of this device the room is at all times supplied with either warm, cold, or mixed warm and cold air. After admission to the various rooms, the air is diffused through them, used for respiration, and discharged through numerous ventilating exits, through which it passes under the floors, warming, them, and is delivered into a foul-air room in the basement, whence it passes through the dry closet vaults to the ventilating chimney, drying the excreta in its passage over it.

The airwarmers or furnaces are enclosed in brick walls. The warm air and ventilating flues are built of brick. The closet vaults are built of brick covered with iron floors. This kind of construction makes the whole warming, ventilating and dry closet plant as nearly fire-proof as possible. The closet vaults are so arranged that their contents can be destroyed by fire without removal from the vaults. This plan most effectually disposes of a most troublesome matter for school authorities to deal with.

There are various ways of applying the system. Many school buildings

in the state use one ventilating duct for each room, instead of passing the foul air under the floors. This is a common way of supplying it to school buildings already built.

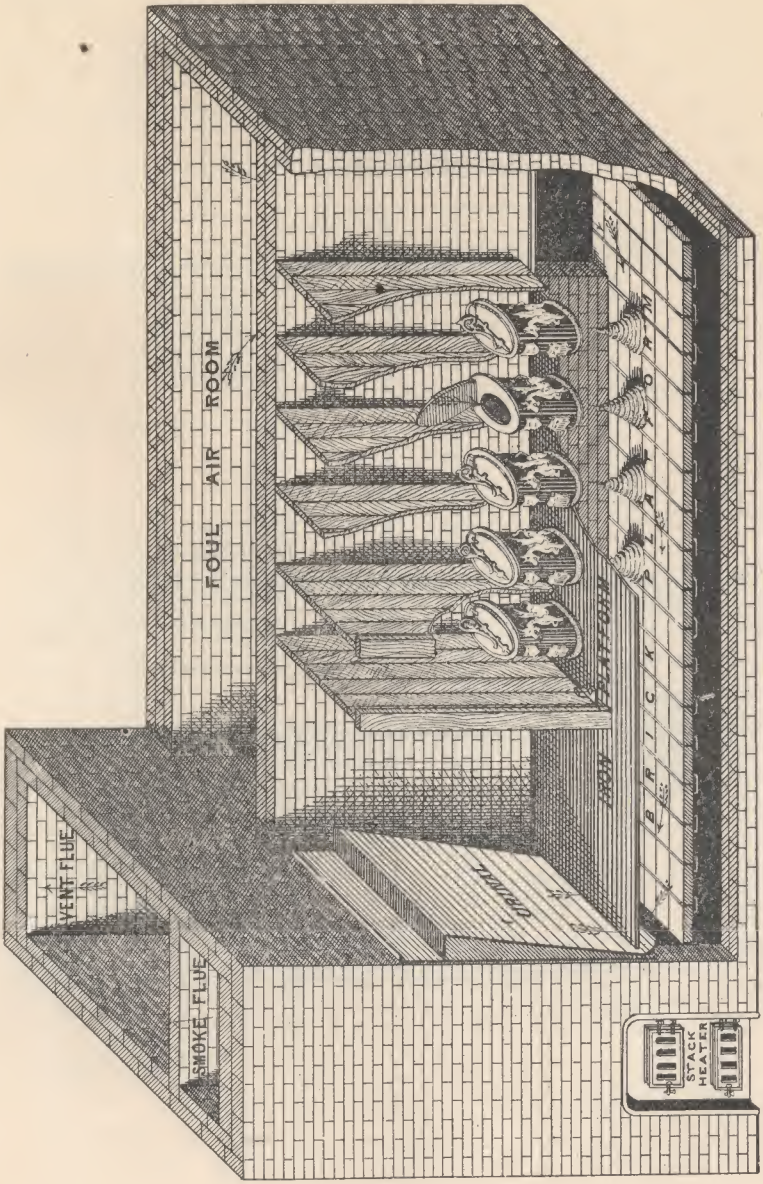
Correspondence in regard to warming and ventilating schools may be addressed to the following firms:

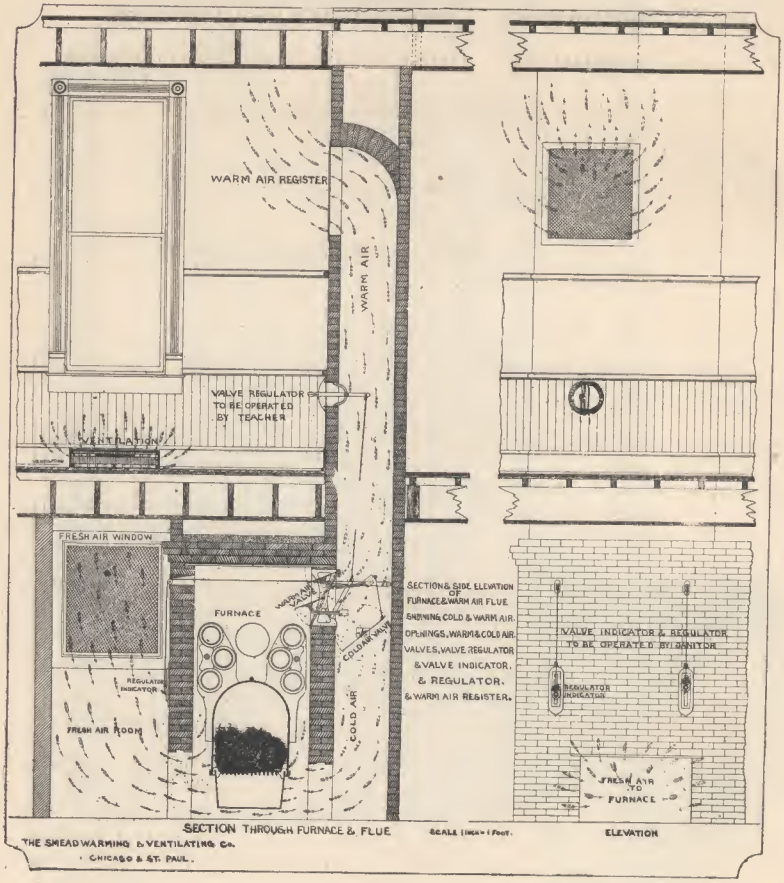
Fuller, Warren & Co., Milwaukee, Wis.

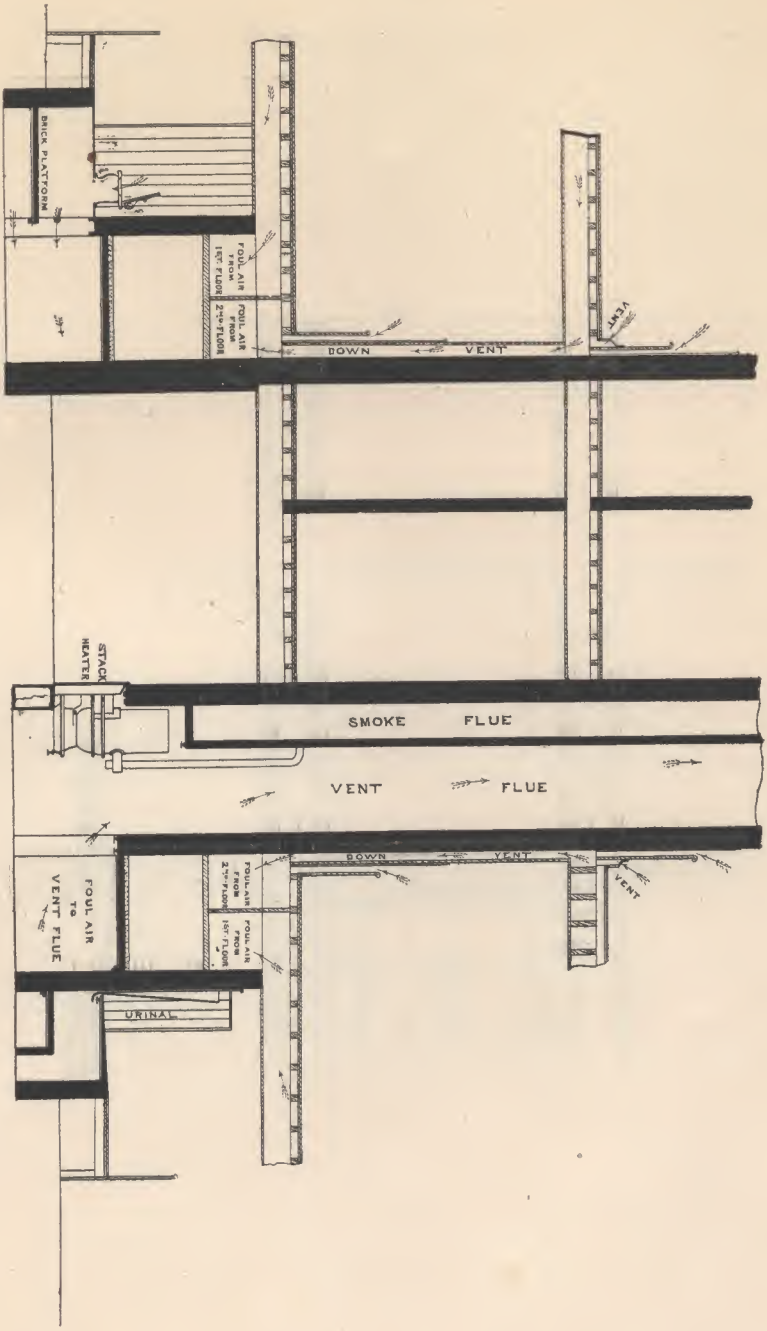
George H. Hess & Co., 63 West Washington Street, Chicago.

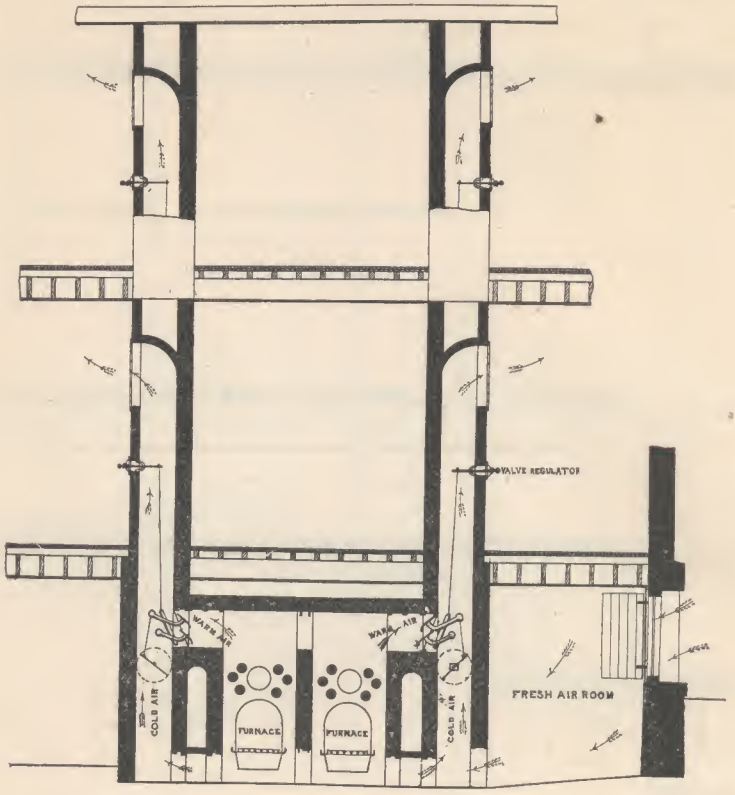
The Boynton Co., Chicago.

Smead Warming & Ventilating Co., 324 Dearborn Street, Chicago.


FOUL AIR ROOM
BRICK PLATFORM
VENT FLUE
SMOKE FLUE
STACK HEATER


WARM AIR REGISTER
WARM AIR
VALVE REGULATOR TO BE OPERATED BY TEACHER
VENTILATION
FRESH AIR WINDOW
FURNACE
COLUMN WARM
COLUMN COLD
REGULATOR INDICATOR
FRESH AIR ROOM
COLD AIR
SECTION & SIDE ELEVATION OF FURNACE & WARM AIR FLUE SHEWING COLD & WARM AIR OPENINGS, WARM & COLD AIR VALVES, VALVE REGULATOR & VALVE INDICATOR. & REGULATOR. & WARM AIR REGISTER.
VALVE INDICATOR & REGULATOR TO BE OPERATED BY JANITOR
REGULATOR INDICATOR
FRESH AIR TO FURNACE
SECTION THROUGH FURNACE & FLUE
SCALE 1 INCH = 1 FOOT.
ELEVATION
THE SMEAD WARMING & VENTILATING CO.
CHICAGO & ST. PAUL.

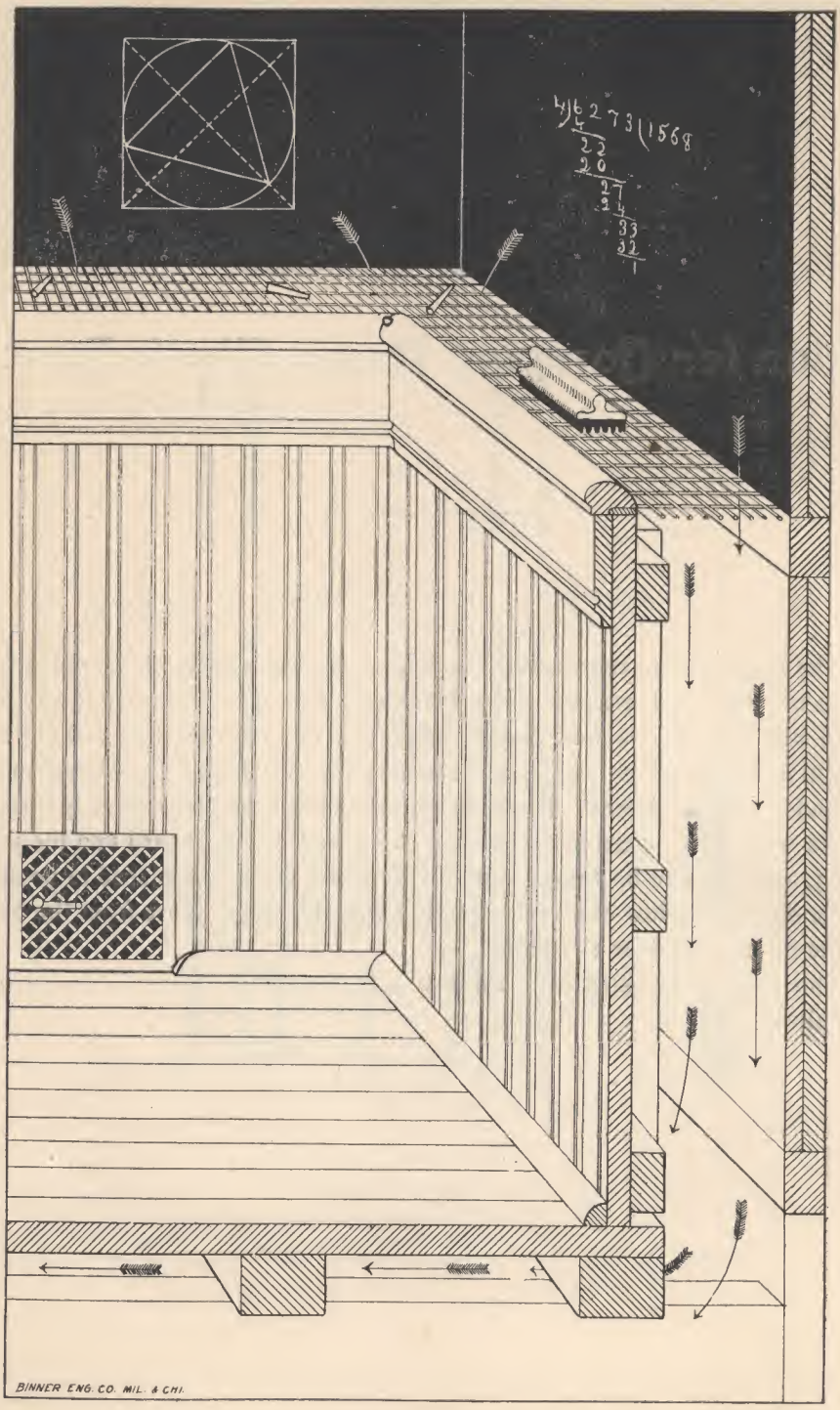

BRICK PLATFORM
FOUL AIR FROM 1ST. FLOOR
FOUL AIR FROM 2ND FLOOR
DOWN
VENT
VENT
STACK
HEATER
SMOKE FLUE
VENT
FLUE
DOWN
VENT
VENT
FOUL AIR FROM 2ND FLOOR
FOUL AIR FROM 1ST FLOOR
FOUL AIR TO VENT FLUE
URINAL


VALVE REGULATOR
WARM AIR
WARM AIR
COLD AIR
COLD AIR
FURNACE
FURNACE
FRESH AIR ROOM

Plan for Carrying Away Chalk Dust.

The following cut represents a method of disposing of the dust arising from the use of chalk and erasers upon blackboards in as satisfactory a way as is known, and the construction may be employed in a new building without cost, in addition to that which would be necessary for the ordinary construction of a wall under the blackboard. It will be noticed that the dust falls directly through an open wire screen fitted into the space between the blackboard and the wainscoting, and will also be shaken out of the eraser when it is placed in position, and the downward flow of air will readily carry the entire refuse from the board into the general outdoor circulation.

This plan of disposing of chalk dust is the invention of Mr. C. W. Bowron, of Oshkosh.


BINNER ENG. CO. MIL. & CHI.

Caution to Builders.

The attention of builders and school boards is called to the following statute:

Section 1636c. (Ch. 190, 1885.) All churches, public and private school houses, hotels, factories, or other manufacturing establishments, constructed at any time after the passage of this act, shall be so constructed that the doors shall swing outward, or both in and out, as the builders thereof may elect.

Where school buildings are recessed for passageways, doors between these passageways and halls or landings should swing outward; wardrobe, recitation and school room doors should swing both ways.

Acknowledgments.

Acknowledgments are gratefully made to the following architects whose works are represented in the preceding pages:

J. Bruess, Milwaukee, Wis., Plans 1, 5.

W. G. Kirchoffer, Elkhorn, Wis., Plan 2.

Edbrooke & Burnham, Chicago, Ill., Plan 4.

H. C. Koch & Co., Milwaukee, Wis., Plans 6, 7.

G. S. Mansfield, Freeport, Ill., Plans 10, 11.

Truman D Allen, Minneapolis, Minn., Plans 12, 13, 15.

——— & Ritchie, Duluth, Minn., Plan 16.

Elah Terrell & Co., Columbus, O., Plan 18.

F. S. Allen, Joliet, Ill.

Additional acknowledgments for courtesies rendered in the preparation of this circular are due to:

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Fuller & Warren Warming & Ventilating Co., 216 South Jefferson Street, Chicago, Ill.

Smead Warming & Ventilating Co., 324 Dearborn Street, Chicago, Ill.

Superintendent R. C. Ramsay, Peshtigo, Wis.

W. H. Nichols, Architect, Delton, Wis.

Joseph Dressen, Architect, Sauk City, Wis.

D. S. Schureman, Architect, Rockford, Ill.

Schnetzky & Siebert, Architects, Milwaukee.

W. H. Smith, Eau Galle, Wis.

John D. Gordon, Jr., Architect, Madison, Wis.

D. R. Jones, Architect, Cambria, Wis.

Prin. J. W. Livingstone, Sparta, Wis.

State Superintendent Stockwell, Providence, R. I.